ORDNANCE

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IN THIS ISSUE

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THE JOURNAL OF THE ARMY ORDNANCE ASSOCIATION WASHINGTON, D. C.

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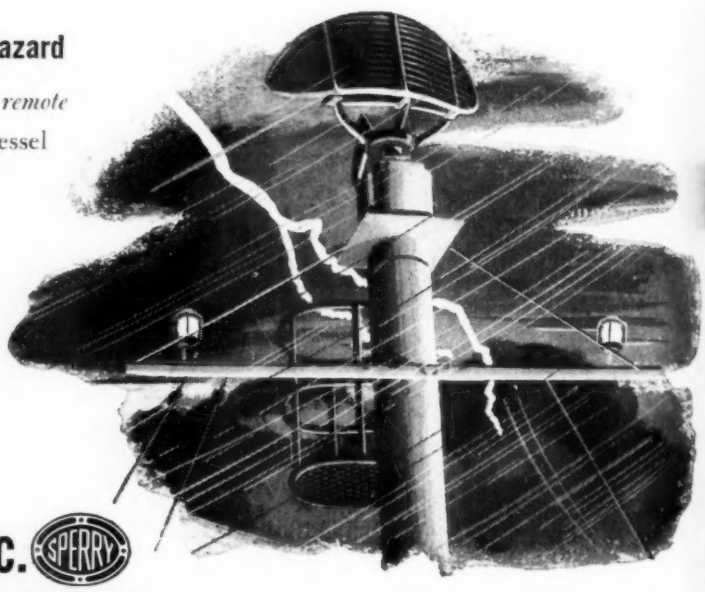

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THE JOURNAL OF THE ARMY ORDNANCE ASSOCIATION

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THE LONG-RANGE AIMS AND PURPOSES OF THE ARMY ORDNANCE ASSOCIATION

1. Adequate national security. This is the great goal of peace. It is best obtained through a nonpartisan and persistent national policy which will ensure that the amount of military power—ground, sea, and air—available to this country and its probable friends will never be less than that available to its probable enemies.

2. Adequate munitions power. This is one of the two basic foundations of military power. The amount of it in quality and quantity available to the United States and its probable friends for timely and effective use should never be less than that available to its probable enemies.

3. Adequate military man power. This is the other main foundation of military power. The amount of it available to the United States and its probable friends should likewise never be less than that required for the timely and effective utilization of the munitions power essential to victory.

4. An ideal basis for achieving adequate munitions power. Existing stocks of munitions plus expected production should equal requirements both in quantity and quality at all times. Consequently, the more the United States can depend upon and speed up the mobilization rate of American industry the smaller the stocks we have to maintain, the more up to date our munitions in time of conflict, and the less the cost.

5. To achieve the above objectives the following principles are advocated:

a. Designs of military armament that are second to none.

b. Existing stocks of combat and other munitions that are adequate in quantity and quality.

c. Efficient and dependable industrial mobilization with maximum shortening of the time factors involved, including the political time factor, the administrative time factor, and the industrial time factor.

d. Current and constant education, training, and development of the military-science-industry team.

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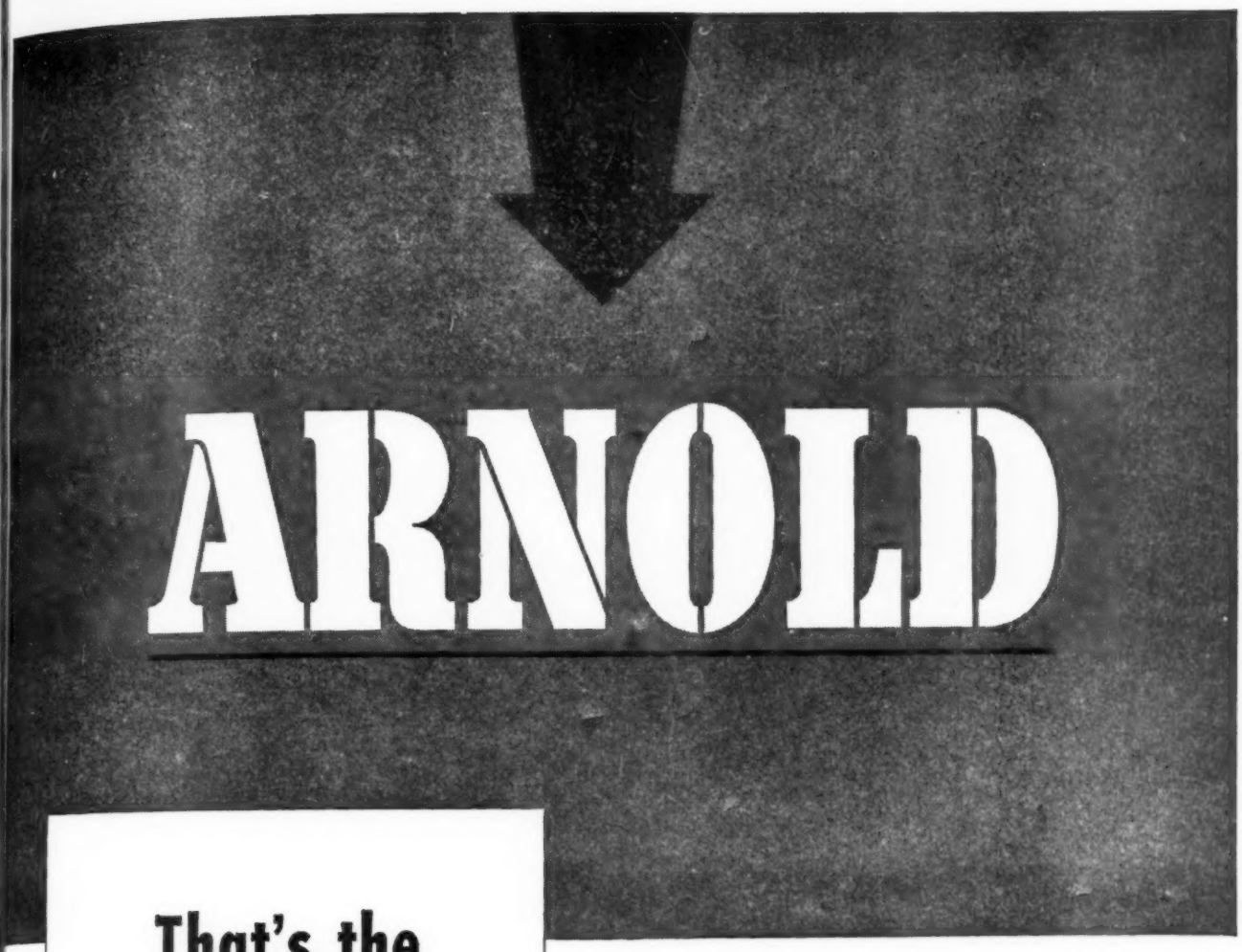

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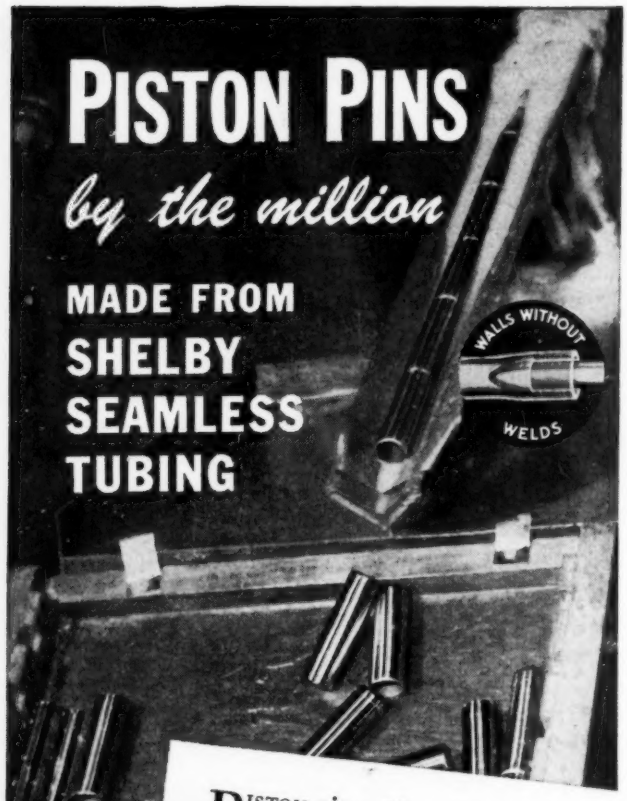

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UNITED STATES STEEL

Atomic Energy

RADIOACTIVE GASES

Reports from the Chemical Corps School, Edgewood Arsenal, Md., state that experiments are being carried on with radioactive gases as part of the Army's program to fit its weapons to the atomic age.

The radioactive gases would be produced by impregnating known war gases with gamma rays in an atomic furnace. Before such gases can be used against an enemy, the Army must find means of providing protection for its own personnel while the gases are being used. A thick wall of concrete or lead is required to hold alpha and gamma rays.

ATOMIC DEVELOPMENT IN FRANCE

The French Commissariat of Atomic Energy is creating a number of laboratories for developing this new source of power. Its program is directed entirely to the utilization of atomic energy for peaceful and civilian purposes. Among the establishments being erected and planned are the experimental establishment at Fort Chatillon in the outskirts of Paris, a uranium refining plant at Poudrerie du Bouchet on the Seine, and an establishment at Saclay, also near Paris, which will correspond to the English atomic-energy plant at Harwell.

BIKINI TARGET SHIPS STUDIED

The Navy is continuing an active program of studying the effects of the Bikini tests. A majority of the target ships surviving the tests are at Kwajalein awaiting ultimate disposition, with a number of them having been earmarked for intensive study at Kwajalein and at naval shipyards on the West Coast and at Pearl Harbor. The ships selected for intensive study include those which have been determined to be the most interesting from the point of view of structural damage and radiological contamination.

The Crossroads target vessels surviving from the second test were heavily contaminated by the radioactive materials contained in the spray which was deposited on them. Until these materials are removed by means of decontamination methods, the ships will be unsafe for permanent occupancy, but personnel can work on board them and stay for a limited period provided certain special safety precautions are followed.

The study and development of effective means of radiological decontamination is one of the most important projects being undertaken by the Navy in its program of preparation against atomic warfare.

MULTIMILLION-VOLT BETATRON

Plans have been completed at the National Bureau of Standards for the erection of two betatrons, enabling scientists to extend research, measurements, and standards development into the 50- and 100-million-volt range.

The betatron is a device for producing electrons or X-rays of extremely high energies and frequencies. Both as an X-ray device and as an electron beam generator the betatron has unusual potentialities in the fields of medical, biological, industrial, and nuclear research.

Many nuclear transformations are brought about simply by exposing materials to the powerful X-ray beam. It is planned to make a systematic study of these transformations, which constitute a phase of atomic research virtually untouched at present.

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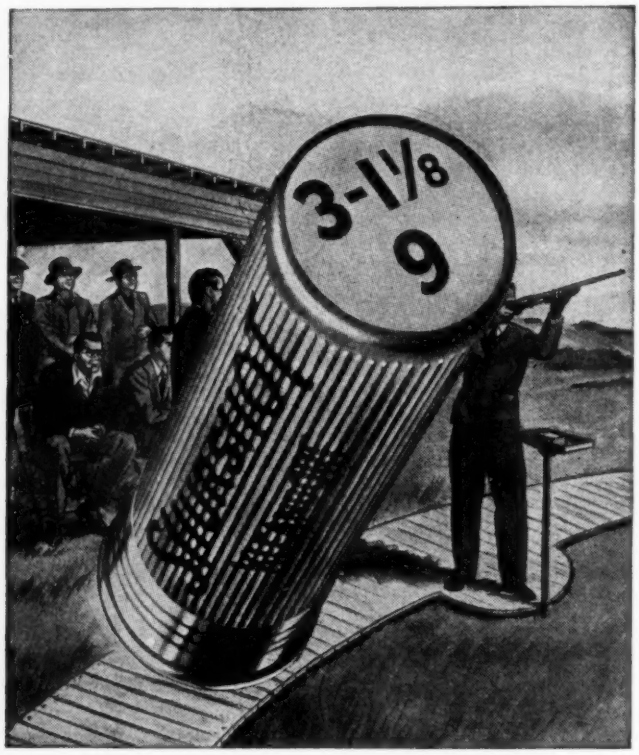

Shoot "Shur Shot" Shells with NEW Remington Crimp

No more blown patterns! That's why Remington Shur Shot shells with the New Remington Crimp make skeet even more fun—scores even higher. This remarkable development by Remington eliminates the top wad which, in ordinary loads, gets in the way of the shot charge about 8 times out of every 100 shots, causing uneven distribution or wide scattering of pellets. The New Remington Crimp leaves no "holes" or thin areas for targets to slip through.

Remington Shur Shot shells have exclusive Kleanbore non-corrosive priming and uniform velocity to get the shot pattern out there *fast*. Also exclusive green, corrugated bodies, progressive burning powder, improved wet-proofing, and patented top seal.

Made in 12-, 16-, and 20- gauge skeet loads and 12-gauge trap. For free literature, write Remington Arms Company, Inc., Bridgeport 2, Conn.

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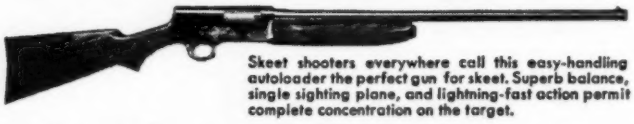


Skeet shooters everywhere call this easy-handling autoloader the perfect gun for skeet. Superb balance, single sighting plane, and lightning-fast action permit complete concentration on the target.

Kleanbore and Sportsman are Reg. U. S. Pat. Off.; Shur Shot is a trade mark of Remington Arms Co., Inc.

New Developments

GROUND

BIOLOGICAL WARFARE

A report prepared by three members of the American Association of Scientific Workers and published in the Journal of Immunology discloses the work on germ warfare by scientists in eight countries prior to 1942. The report sets out thirty-three diseases of man, animals, and plants which possibly could be employed with destructive effect in war, and lists thirty-seven others which appear to be unsuitable for war use.

Among the maladies listed are: an unusual type of tularemia (rabbit fever) causing pneumonia which can be transmitted by air; pneumonic plague, the lung form of Black Death, also spread by air; melloidosis, a rare but almost always fatal lung disease; anthrax, a quick-killing form of yellow fever spread by air instead of by mosquitoes; undulant fever; parrot fever; tick-borne infections; botulinus poisoning; and the common cold.

NEAR-MISS MORE POWERFUL

After years of learning how to hit a target, science has finally decided that it may be better to miss it a little. This was brought out in a series of papers at the American Physical Society. Both in theory and in experiment, experts on fluid dynamics have proved that a shock wave that strikes a glancing blow is more effective than one that smashes directly against its target. In extreme cases, the proper angle gives almost fifty per cent more pressure and hence more damage.

ARCTIC TROOP SHELTER

A prefabricated temporary Arctic shelter for troops, capable of providing an interior temperature of 70 degrees Fahrenheit while the outside thermometer registers 70 degrees below zero and also capable of withstanding the impact of a 125-mile-an-hour wind, is being designed by the Corps of Engineers. Present plans call for a building light enough in weight to be transported by airplane or glider and so simple in construction that it can be erected quickly by unskilled men wearing Arctic clothing.

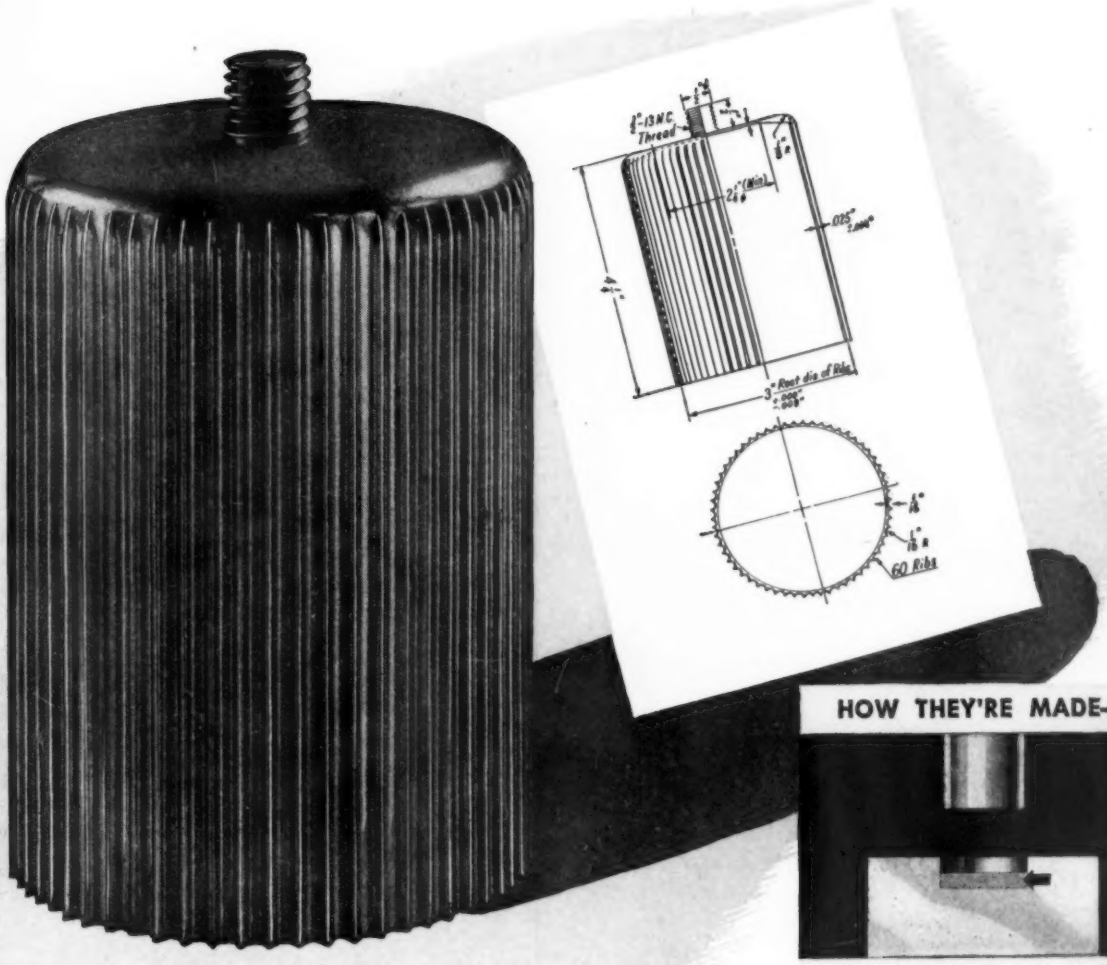
SNOW SLED IN THE DESERT

The Army's one-ton cargo "snow sled," which proved highly successful in trials in Alaska, is sliding over the hot desert sands of Arizona undergoing new tests by "Task Force Furnace." If the sled, weighing only 450 pounds without pay load, survives the rugged testing over desert terrain, the Army will have a low-cost, lightweight, heavy-duty trailer equally efficient on snow or sand.

LIGHTWEIGHT RADAR

A lightweight radar set which could be transported by plane and set up in forward areas inaccessible to larger detector equipment was recently revealed by the Signal Corps.

This equipment, officially designated as the AN/TPS-3, was designed and developed at the Evans Signal Laboratory, Belmar, N. J. Although the set weighs only 1,340 pounds when packed and requires only one operator and one maintenance man, it is extremely accurate and exceptionally rugged. It was designed to withstand temperatures between 40 degrees below zero Fahrenheit and 140 degrees above, and humidity ranging up to 100 per cent. With auxiliary equipment it identifies aircraft within its range as friend or foe. *(Continued on p. 78.)*



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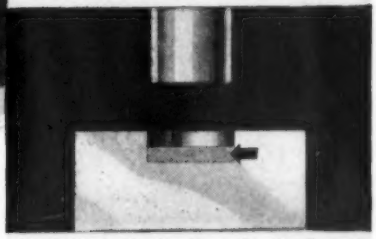
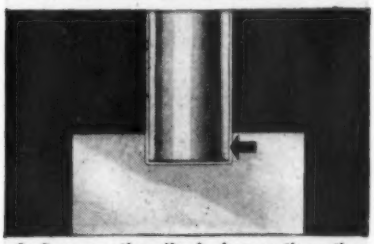
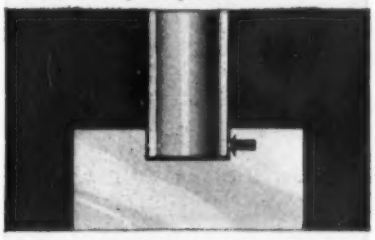
HOW THEY'RE MADE—



1. A slug of aluminum is struck one sharp blow in a die by a punch.



2. Because the die is larger than the punch, the metal *flows* out of the die and *shoots* up the punch.



3. The space between the die and punch determines wall thickness. The external design features are incorporated in the die, the internal in the punch.

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New Developments

LEADERSHIP TRAINING

Army Ground Forces, realizing the immediate need for developing leadership, has established a Potential Leaders' Course at replacement training centers. Approximately 960 students will be enrolled in the 4-week course when the classes are running at full capacity. Purpose of the course is to select potential leaders from among the trainees at replacement training centers early in their military careers, teach them what is expected of Army leaders, and develop their natural attributes of leadership.

CENTRALIZED SUPPLY SYSTEM

The War Department has ordered the centralization of most Army supply for all ground and air units. The order followed a 3-month trial period in the southeastern United States.

Under the new system, all using units will requisition on the five general distribution depots for all supplies except perishable subsistence, gasoline and lubricants, ordnance ammunition, repairs and utilities supplies, and specialized supplies of the Adjutant General's Department, Army Air Forces, Army Exchange Service, and Special Services Division. Excepted items will be requisitioned in the present manner.

SEA

NAVAL ORDNANCE DEVELOPMENTS

Ordnance research has recently developed a target-seeking electric torpedo whose characteristics are secret but which should prove vital to antisubmarine-warfare units in combating the new fast type submarine. Research has also developed a homing aircraft torpedo and a homing chemical torpedo for surface use. These will greatly increase the safety, accuracy, and distance or range at which attacks can be made and will reduce the possibility of successful countermeasures.

NAVY IN THE DESERT

"Big Dick," "Tiny Tim," and a whole family of new rockets and guided missiles are being developed and tested at the $100,000,000 Naval Ordnance Test Station in the heart of the California desert. The station consists of 1,010 square miles of desert and rugged mountain terrain. Its function is the research, development, and testing of new weapons, primarily rockets, guided missiles, and aviation ordnance—weapons for use by planes and against planes.

The "Tiny Tim," large air-borne rocket developed in wartime, already has been surpassed by the giant "Big Dick," a 14-inch rocket designed for use by planes against ships or land targets.

BANSHEE FIGHTER

The McDonnell jet-propelled Banshee, described as the most powerful single-seat fighter flown in the United States today, will soon join the U. S. Navy. It is in the 600-mile-an-hour class and can climb at a rate of 9,000 feet a minute. It is powered with a pair of Westinghouse axial-flow turbo-jet engines and can operate on either one or both of them.

NEW NAVAL TEST STATION

Testing of propulsion units and aërodynamic design features for missiles is scheduled to begin shortly at Holly Ridge, N. C., where the facilities of Camp Davis, a former Army and Marine Corps base, have been converted to form the Naval Ordnance Test Facility. Units to be tested will include the supersonic ram jet, which was designed and is now under development as a propulsion unit for missiles. *(Continued on p. 80.)*

Timken Axle-equipped trucks like this cementing rig do a giant's job in the oil fields of California.

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By COLONEL LESLIE E. SIMON

An accurate and dramatic record of Nazi science and business at war. Colonel Simon draws on his broad experience to explain—with examples—not only the extent to which the Germans succeeded or failed, but *why* they did.

This absorbing book analyzes the factors that kept many new devices from completion. It describes, organization by organization, the lack of coordination among scientific groups of the Army, Navy, and Air Forces; it reveals the jealousy that existed between scientists and engineers.

Of particular interest are the descriptions of new scientific developments relating to the more important researches in interior ballistics, terminal ballistics, exterior ballistics and fire control, aërodynamics, and instruments and measurement technique.

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New Developments

EJECTION CAPSULE FOR AIRCRAFT

The Navy's air arm has developed an "ejection capsule" for bringing to earth safely the crew of an aircraft involved in an accident while flying at supersonic speed in the stratosphere.

The seats developed during World War II for catapulting a pilot clear of his aircraft would not be practical in future aircraft types for pilots probably would be torn apart if they were ejected by such seats at supersonic speeds and might die from lack of oxygen, if they survived the initial shock.

SHOCK-RESISTANT LIGHTS

Development of efficient blast- and shock-resistant light fixtures for warships is the goal of a comprehensive study now being made by a group of twenty civilian illumination engineers, working with representatives of the Bureau of Ships. Commercial lamps and fixtures are too fragile and often too dangerous for warship installation. The shock of gunfire will frequently shatter glass fixtures. Battle experience demonstrated that the glassware on these fixtures was a serious missile hazard when broken by enemy shells or bombs.

AIR

TELERAN FOR AIR NAVIGATION

Employing principles and equipment developed during the war for radar and air-borne television, Teleran is now being designed to provide the pilot with an "aërial road map" combining in a single clear picture on his instrument panel all the traffic, route, weather, and special information needed.

MOST POWERFUL JET ENGINE

The most powerful American turbo-jet engine, producing a rated thrust up to 5,000 pounds, has been developed for the Army Air Forces by the Menasco Manufacturing Company of Burbank, Calif. Packing more power than a Diesel electric railroad engine into less than one-fifth of one per cent of the Diesel's weight, the new engine has been designated the XJ-37.

ALTERNATING CURRENT FOR BOMBERS

The first practical application of alternating-current electric plants for aircraft was recently disclosed. These A.C. generators provide fifty per cent more power per pound of weight than comparable direct-current generators. The newly developed equipment has been installed on two of America's giant bombers, the Consolidated B-36 and the Northrop B-35 Flying Wing. Four generators, or alternators, were built for the B-36 and three supply the electrical needs of the Flying Wing. Weight economy and more efficient trouble-free operation, especially at high altitudes, are the chief advantages of the alternating-current system.

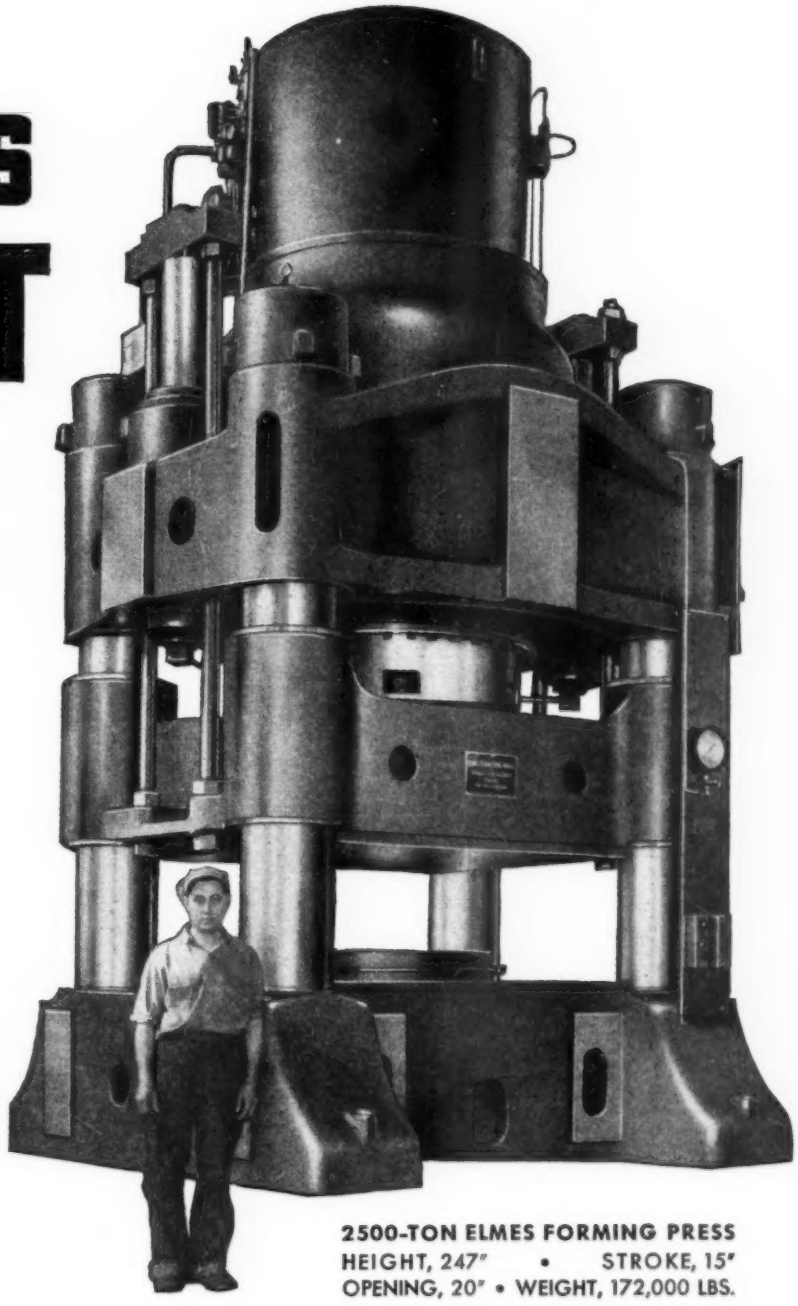
DOUGLAS TO STUDY XS-3 DESIGN

The Army Air Forces has awarded a contract to the Douglas Aircraft Company, Santa Monica, Calif., for a design study of the third of a series of supersonic aircraft, which has been designated the XS-3. The study is being directed toward the development of a design capable of speed three times that of sound and with an altitude ceiling of 200,000 to 300,000 feet.

So far the Douglas company has made sixty different design studies, ranging from a stubby, blunt-nosed model to a long, slender fuselage that comes to a sharp bulletlike point fore and aft. Ram-jet, rocket, pulse-jet, and turbo-jet types of propulsive units, both singly and in combination, have been studied as possible propellants. *(Continued on p. 82.)*

WORTH ITS WEIGHT

. . . and it weighs more than 85 tons



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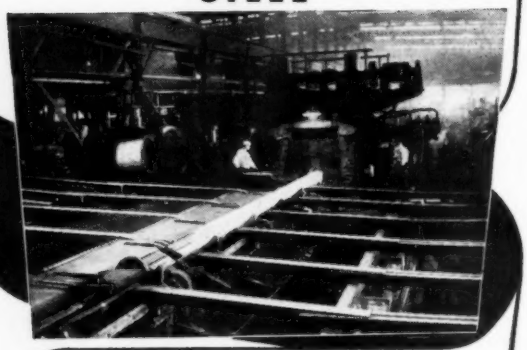
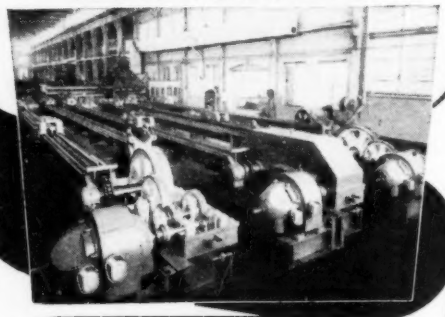


NON-FERROUS



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New Developments

NEW NAVIGATIONAL SYSTEM

A new navigational method which indicates a savings up to approximately twenty per cent of the time required for long-range flights has been developed by the Air Weather Service of the Army Air Forces. Research began on the new method, known as the "minimal flight path," a form of pressure-pattern navigation, more than three years ago when veteran pilots noted that while the great-circle route was the shortest distance between two points on the earth's surface, excessive head winds and other atmospheric conditions sometimes encountered caused increased time to be needed for such flights.

It was discovered that deviations as much as 200 miles from the great-circle route made it possible to take advantage of tail winds and reduce flying time for the course. The science of preparing such a route has been developed to a point that an experienced weather office can prepare a flight plan in thirty minutes or less which will reduce the flying time for a cross-country flight from ten to twenty per cent.

WING-TIP RAM JET

A North American P-51 Mustang equipped with twin ram-jet engines, one mounted on either wing tip, has been under study by the Air Matériel Command. Because the ram jet does not have effective power at low speeds it requires another type of power plant for launching to establish an operating speed. The P-51 attains a speed of 250 miles an hour before the pilot cuts in the twin ram jets, jumping the speed of the Mustang an additional one hundred miles an hour within seconds.

POLAR WEATHER RECONNAISSANCE

A series of routine weather-reconnaissance flights over the North Pole has been started by the Air Weather Service of the Army Air Forces in a Boeing B-29 Superfortress. The flights will obtain weather information which will be made available to all weather-forecasting agencies of this and other countries. Flights are now being made every few days, but later daily flights will begin to obtain synoptic meteorological reports over an extended period.

AUTOMATIC FLIGHT RECORDER

Development of an automatic flight recorder, designed to provide recorded data which will help determine the cause of aircraft mishaps has been developed by General Electric Company. The new instrument also provides airlines with easily read records of a plane's altitude, vertical acceleration, air speed, compass heading, and much other operational data.

ALL-WEATHER AIRLINE

The Army Air Forces All-Weather Airline, familiarly known to pilots as the "Green Ticket Run," finished its first six months of operations with a better than ninety-eight per cent record of flights completed during some of the year's worst flying weather. Douglas C-54 Skymasters of the All-Weather Flying Center, a division of Air Matériel Command, have been flying a 5-day-a-week schedule from their home base at Clinton County Army Air Base at Wilmington, Ohio, to Andrews Field, Md., and return.

All the flights are made either under actual instrument conditions or "under the hood." In order to test the efficiency of all equipment being used in the trials, the initial order of the All-Weather Flying Center was that all take-offs and landings, as well as intervening flights, would be made under theoretical zero-zero conditions, so that when actual instrument conditions do not exist the pilot places red polaroid glass over the windshield and dons blue goggles, thereby blacking out anything outside the cockpit. Under the conditions imposed by the "hood," each C-54 engaged in the all-weather experiment is flying under conditions which normally would ground every airplane in the country.

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Firepower at Sea

Naval Ordnance Still Rules the Waves

THE lack of an enemy navy today does not eliminate the need for one of our own. The Japanese Imperial High Seas Fleet was to all intents and purposes beaten, routed, and broken by the U. S. Third and Seventh Fleets in the great engagements now called the Battle for Leyte Gulf (October 1944).

Yet in the assault upon Okinawa the American fleet expended 300,000 rounds of ammunition of all calibers in a single month. The total ammunition expenditure at Okinawa was almost 50,000 tons.

American ships, American antiaircraft fire, and American naval planes in 7 weeks of savage fighting against kamikaze and other land-based air attacks shot down a total of nearly 4,000 planes.

As long as we control the sea we cannot be attacked except by air-borne weapons, and their effectiveness will be reduced in proportion to the distances they must traverse. As long as we control the sea we can attack any target within reach of the aircraft and other weapons we carry in our ships.

This control of the sea, so vital to our freedom and to all it stands for in a darkening totalitarian world, can be achieved only by sea power. Our sea power is a combination of combat and auxiliary ships and planes, well-trained personnel, and dependable ordnance.

During World War II, our 18-billion-dollar Navy spoke everywhere with authority. It had more than 7,500 ships, 40,000 planes, 4,000,000 personnel, and 85,600 guns.

In 1942, naval expenditures averaged $29,210,411 a month for all types of ammunition. In the closing year of the war, when production reached its peak, the Navy turned out each month about $240,000,000 worth of ammunition.

Figures from some of the major Pacific campaigns further indicate the vast quantities of ammunition that were expended. At Tarawa, the Navy used 3,000 tons of gun ammunition. The Marshalls took 16,000 tons. In the Marianas, Navy guns fired 36,000 tons before Tinian, Guam, and Saipan were taken. Even little Iwo Jima was pounded with 16,000 tons.

While Navy ships and planes were blasting an invasion path from New Guinea to the Japanese heartland itself, other Navy combat craft—ships, planes, and submarines—were methodically destroying not only Japanese sea power but Japan's logistical ability to continue the savage fight.

According to a booklet recently prepared by the Joint Army-Navy Assessment Committee, U. S. forces sank 611 Japanese naval vessels or 1,822,210 tons of enemy naval craft. The number of Japanese merchant ships destroyed was 2,117 or 7,913,858 tons.

Considering only the Japanese phase of the war, the record shows that submarines accounted for 201 naval vessels and 1,113 merchant ships. Surface craft destroyed 112 naval vessels and 11 merchant vessels. Navy-Marine aircraft destroyed 70 enemy naval vessels and 240 merchantmen.

The destruction of nearly 3,000 Japanese vessels of all types, or nearly 10,000,000 tons of enemy naval and merchant shipping, is conclusive proof of the devastating firepower of the mightiest Navy in the world. The accomplishments of the Atlantic, Mediterranean, and other elements of the Fleet were equally creditable.

The U. S. Fleet today is undergoing many modifications as a result of the Bikini bomb test. The American Navy of the future will have heavily armored guided-missile ships, rocket ships, pilotless aircraft, and radically new antiaircraft and antisubmarine weapons. Jet planes will necessitate new techniques in air warfare. Submarines seem destined to assume an even greater importance.

Our future Navy, however much it may be modernized, will still depend for its striking power upon ordnance and upon large tonnages of superior ammunition.

Let us keep our Navy strong so that, in the event of a future emergency, naval ordnance will speak in our defense with the same smashing decisiveness as in the recent conflict—on the sea, over the sea, under the sea.

The new Chief of the Navy Bureau of Ordnance is a first-rate fighting man, Rear Adm. Albert Gallatin Noble.

A graduate of the U. S. Naval Academy and the Massachusetts Institute of Technology, he has achieved unusual distinction as a teacher of ordnance; as a producer and distributor of ordnance while serving in the Bureau of Ordnance as assistant director of the Production Division and later as director of the Planning and Progress Division; and, finally, as a daring and skillful user of ordnance in two world wars.

During World War I, Admiral Noble served on the U.S.S. DELAWARE which operated with the British Grand Fleet. During World War II he rendered distinguished service to his country in combat against the Japanese.

In the spring of 1943, as commanding officer of the U.S.S. PHOENIX, he took part in the forward movement of the allies in the Southwest Pacific Area.

During the assault on Hollandia, he commanded an amphibious group that made up the landing force at Aitape, New Guinea. The following month Admiral Noble commanded a naval force of cruisers, destroyers, transports, and miscellaneous landing craft in operations of the Wakde Island area.

In March 1945, Admiral Noble was assigned to duty as Commander, Amphibious Group 8, and demonstrated superb leadership and resourcefulness during the landings in the Philippines and Borneo. He later supported landing operations in the occupation of Japan and Korea.

We salute Navy Ordnance and wish Admiral Noble a most successful career as its new chief.

—THE EDITORS.

STILL THERE.—*The Stars and Stripes flies proudly in the Pacific breeze over the carrier* U.S.S. LEXINGTON—*a "revenge" carrier which paid back part of the debt owed the Japs for sinking its namesake (Navy photo).*

The Artillery Rocket

Its Influence on Military Design and Tactical Organization Today

by

Maj. Gen. J. F. C. Fuller

An old weapon provided a new answer to many modern tactical problems

FOR over 400 years the cannon, either as hand-gun, horse-gun, motor-gun, ship-gun, or flying-gun has dominated fighting. And with the exception of the fortress-gun—a fixed piece—the main problem it gave the soldier was one of weight—that is, of carriage and movement.

It was the weight of these weapons as it affected mobility, as much as their respective functions, which dictated design and organization. And because organization is shaped around mobility, it therefore follows that a substantial reduction of weight carries with it a potential tactical revolution.

It is on the threshold of such a revolution that we stand today, for many things point to the shedding of weight—the slimming of weapons. The atomic bomb, the guided missile, the proximity fuze, and the rocket all do so, directly or indirectly. It is the last of these weapons which definitely challenges the dominance of the cannon.

Prove Useful

From 1806, when first used in a naval attack on Boulogne, onward to the Battles of New Orleans and Waterloo in 1815, rocket batteries and rocket ships, the first on account of their mobility and the second on account of their shallow draft, proved so useful that after the Napoleonic Wars the rocket was adopted by every organized army.

In 1846 it was improved by William Hale, an American, who substituted three vanes for the cumbersome stabilizing stick; these, when acted upon by the exhaust gases, caused the rocket to rotate about its longitudinal axis and thereby added to its accuracy.

In spite of this improvement, and on account of the introduction of the rifled gun, from 1850 onward the rocket went out of use, the British Army being the last to abandon it in 1885. From then on, with the solitary mention of a Japanese rocket-grenade used during the Russo-Japanese War, for over fifty years it ceased to be an ordnance store.

The second phase in its history opens in 1918. In that year two Americans, Dr. R. H. Goddard and C. N. Hickman, set about developing "artillery rockets" for the U. S. Army, and though with the coming of peace the project was dropped, the idea lived on —not in the form of a projectile but instead in that of a reaction propulsion engine for stratospheric flight.

Several countries were bitten by this idea and particularly so Germany, her most noted rocketeer being Prof. Hermann Oberth.

The error the Germans fell into was due to not asking themselves from the start, "What is the problem?" Had they done so, they would have seen that it was to increase or impede tactical mobility; for movement and not destruction is the aim of tactics. Because they did not do so but instead, as an English rocketeer wrote in 1935, were "busily engaged in seeking means of destroying cities hundreds of miles away by means of stratospheric rockets," they did not see the problem in its true light.

The rocket is more effective than the gun for volume fire at comparatively close ranges and against targets either in the open or protected by defenses of medium strength. The cannon is more effective than the rocket for accurate aimed fire at distant ranges and against targets either in the open or protected by defenses of great strength.

Therefore, the conclusion is that, except for the long-range rocket and certain of the aircraft-carried rockets, the rocket is an in-fighting weapon. How long this will remain so will depend largely on improvements in its fuel and the means of directing its flight with increased accuracy.

General Fuller, noted British soldier-author, is one of the outstanding military analysts and historians of the present day. As an officer in World War I he was one of the foremost advocates of tank warfare and did much to mount the armored attacks that proved the value of the bullet-proof track-laying vehicle. He is a Companion of the Bath, a Commander of the Order of the British Empire, and a Companion of the Distinguished Service Order.

Bridging the Gap

What do we see during the third phase of the history of the rocket? That in nearly every instance it was the unbridged tactical gap which suggested its use as a gap-spanner. And though many of the gaps were hoary with age, they were either accepted as permanent or the attempts made to bridge them were restricted to existing means—bullets, shells, and bombs propelled from some form of cannon or dropped by aircraft. Nevertheless, immediately after the war started it was found that none of these means footed the bill. Whereupon the tactical designer at once turned to the rocket.

With varying degrees of success seven main tactical gaps were tackled. Three were defensive in character—the use of the rocket as an antiaircraft, antitank, and antisubmarine projectile. Four were offensive—its use as air, field, naval, and siege artillery. These I will briefly examine in turn.

The Antiaircraft Artillery Problem: *To supply all attackable targets with mobile local protection against air attack.*

To attempt to do so with artillery is not a practical proposition; for though shells can be made by the million, guns cannot be. But to all intents and purposes the rocket is a shell and gun combined. In 1940, when there were no more than 500 antiaircraft guns in the United Kingdom, the British introduced the antiaircraft rocket to supplement their fire.

U. S. Army's 4.5-inch artillery rocket with lightweight launcher.

After the failure of the German air attack it would appear that, because so many other urgent calls had to be met, the development of this projectile was not pushed. Nevertheless, there can be little doubt that, when combined with the proximity fuze, the rocket has a considerable future as an antiaircraft projectile. It is inexpensive, easily launched, and economical in personnel.

The Antitank Artillery Problem: *To give the man on the spot a powerful antitank weapon which can be immediately available and one that can come to his support in the shortest possible time.*

The solution of the first part of this problem depends on portability; that of the second on speed of movement. To be immediately available, like a rifle the weapon must be light enough to be man-carried, as was the first antitank weapon—the German 1917 A.T. rifle. However on account of its recoil it was impracticable, and after World War I it gave way to a variety of small-caliber cannon. But all were too heavy to be rapidly manhandled, and their power to penetrate the ever-increasing thickness of armor was soon outgrown.

As regards the second part of the problem, clearly an antitank weapon mounted in an airplane possesses the maximum mobility; but here again the weight and the recoil of the cannon are the limiting factors. It had to be of very small caliber or else bombs had to be relied upon, as in the dive bomber.

In both cases the solution was found in the rocket, first by the American bazooka, a weapon which could be brought into action by two men and from which a rocket could be launched that would shatter heavy armor. The original model of this weapon appeared in 1942 and was first used in the allied landings in North Africa. It was a tube 54 inches in length weighing 14½ pounds. The 2.36-inch rocket fired from it had an effective range of 200 to 300 yards.

The bazooka was copied by the Germans in their *Panzerfaust* and *Panzerchreck,* and, though more powerful weapons, they were inferior in range.

Thus the first part of the problem was solved by the rocket because of the lightness of its launcher, the absence of recoil, and the power of its war head.

The defeat of heavy armor was accomplished once the aircraft-carried cannon was replaced by the aircraft-carried rocket. This was first done in Russia in 1942 by mounting rockets in Sturmovik ground-strafing aircraft. These machines were designed to fly at very low altitudes and destroy enemy tanks, vehicles, etc. This method of bringing rapid antitank fire to bear was soon adopted by all belligerents and was brought to its highest perfection in the American 5-inch HVAR (high-velocity aircraft rocket), commonly called "Holy Moses." This projectile was 6 feet long, weighed 140 pounds, and had a velocity of 1,375 feet a second.

The Antisubmarine Artillery Problem: *To bring underwater fire to bear on a submarine immediately its position is signaled; that is, during the interval in which surface craft are moving into position to drop their depth charges.*

To fill this time gap the British invented what was called the "Hedgehog"—a series of mortars from which bombs were fired ahead of the ship. However, because of their recoil the mortars could not be fired from ships smaller than destroyers—a grave disadvantage.

In 1942 this was overcome by substituting rocket launchers for mortars. The launcher consisted of a series of rails fanned out slightly from parallel so that the rocket bombs would fall in line at right angles to the course of the ship. Though a hit might or might not sink a U-boat, it seldom failed to rupture its hull, forcing the vessel to the surface where it could be destroyed by gunfire.

As Plane-to-Plane Artillery: *To increase fighter projectile power against fighter and bomber aircraft.*

Like so many problems involving the cannon, this was one of weight and recoil. Therefore once again a solution was sought in the rocket, but seemingly only by the Germans. In 1943 they launched fleets of rocket-carrying fighters against the then-unescorted U.S. bombers and, we read, were "uncomfortably successful, especially during and immediately after the period of the Schweinfurt raids."

But later, when American bombers were escorted by fighters, slowed by the drag of the launcher installation the German rocket-carrying plane became an easy target for the unhampered escort fighter. Nevertheless, when rocket-carrying aircraft are protected by fighters or have retractable launchers, there should be ample room for future development of the rocket in plane-to-plane fighting.

As Field Artillery: *To span the fire gap in the final stage of the assault or in the initial stage of a sea-borne invasion.*

This use of the field gun has always been a most difficult problem. On land the solution has long been sought in artillery bombardments or in barrages—standing, creeping, or jumping—but in all these covering operations the difficulty still remains one of how to span

the last lap of the assault. This difficulty is due to the immobility of the field gun because of its weight which demands horses or tractors for movement.

In part, because of their armor, the tank and self-propelled gun solved the problem; yet seldom could either develop the weight and volume of fire necessary to obliterate opposition.

Though, when compared with the field gun, the rocket lacks range, velocity, and precision, its absence of recoil, making lightweight launchers possible, enables it to be brought into action easily and rapidly in places where field guns cannot go.

Multiple Rocket Launchers

Of the multiple rocket launchers several types appeared: the American Xylophone and Calliope, the Russian Katyusha, and the German *Nebelswerfer*. The first consisted of eight 7½-foot tubes mounted side by side on a simple frame which could be elevated from 5 to 45 degrees. It weighed 800 pounds, and, if required, two of these launchers could be fired from the bed of a 2½-ton truck.

The Calliope was designed to enable a tank to lay its own covering barrage. It consisted of sixty 7½-foot tubes mounted on the turret of a tank. The launcher could be jettisoned after use.

By the end of the war these two weapons were respectively outclassed by the "Honeycomb" and "Hornet's Nest," both American. The first was a 24-tube, 1,200-pound launcher mounted on a 2-wheel carriage, and the second consisted of sixty 36-inch tubes.

At sea the problem was identical; namely, to span the gap between ship and shore or surf and beach, thereby enabling the invading forces to get a grip on the latter. Neither ship guns nor aircraft bombs could solve this problem.

The rocket, however, could and did, and by doing so it radically changed the complexion of overseas invasions because it compelled the defenders to pull back from the beaches out of range.

As Naval Artillery: *To increase the range of naval ordnance in order that warships can engage at ever-increasing distance.*

Until the rocket appeared, the solution was sought in the aircraft carrier bombing plane and with startling results, as seen in 1942 in the Battles of the Coral Sea and Midway Island. The snags, however, were the inaccuracy of the bomb and its low penetrating power. These limitations were largely overcome by substituting rockets for bombs.

Toward the end of the war the Americans produced an 11¾-inch rocket popularly known as "Tiny Tim." Its length was 10 feet 3 inches and its weight 1,284 pounds. It has been stated that it gave the fighter plane "the punch of a 12-inch gun." There can be little doubt that in naval warfare the bomb is now an obsolete weapon.

As Long-Range Siege Artillery: *To produce the maximum destructive effect on targets of military value at ever-increasing range.*

Though the heavy bomber, when used in numbers, did solve this problem, because of the inaccuracy of its aim it was compelled either to strike at vast targets, such as large towns and cities, or else carry out a series of raids against smaller ones.

This vast cost in matériel and personnel was obviated by the German V-1 flying bomb and V-2 rocket.

The V-2—unlike the V-1 which was not a rocket—was a gigantic projectile forty-seven feet in length, weighing about fifteen tons. Its war head carried 1,000 kilograms of explosive, its maximum velocity was 3,500 miles an hour, and its maximum range 200 miles. It was a complicated machine somewhat erratic in its flight. Yet, range for range, it was a more accurate projectile than the bomb dropped from a high altitude.

V-2 Versus Bomb

Thus, whereas a bomb dropped from an altitude of 5 miles frequently misses the center of its target by 1 to 2 miles—often more—the V-2 rocket fired at a range of 200 miles generally fell within 10 miles of the center of the target and seldom more than 20 miles away from it. Theoretically, therefore, whereas the bomb error was from 20 to 40 per cent of the altitude, the error of the V-2 was only from 5 to 10 per cent of the range.

For practical purposes, however, the V-2 did not solve the problem of increased accuracy. What it did do was to demonstrate experimentally that it was possible to carry out bombardments up to a range of 200 miles without the use of aircraft and aircraft personnel.

What do these seven problems teach us? Not only that Congreve's prophecy is being fulfilled but something far more important. They reveal to us the secret of military design and organization—the most important factors in military development.

To begin with, let us remember this: The rocket was the oldest of all gunpowder-propelled projectiles. How came it then that it took over 700 years before its tactical powers were fully appreciated?

The answer to this question is a simple one. It is that military designers did not trouble to think clearly. Had they, from the start, asked themselves the question: "What is the problem?" And had they meditated on its answer, they would have seen that, whatever the means—rocket, cannon, horse, man, ship, machine, etc.—*it was to increase mobility on the one hand and impede it on the other.*

Next they would or should have asked themselves: "How can mobility be increased?" This question would have led them to the next: "Where is it lacking?" Its answer would have brought them face to face with what I have called "the tactical gaps."

These would have become their starting points, and once they were clearly fixed in their minds, their task would have become one of spanning them. How? Either by suggesting ideas to inventors—scientists, technicians, etc.—or, when a novelty appeared, by considering it at once from the points of view of the gaps.

Also with the rocket: Had the problem of gap spanning been clearly appreciated in 1918, Goddard's experiments would not have been abandoned. In 1933, when Hitler impounded German experimental rocket work, had this same problem been clearly seen it would have been realized that, because the German Army was organized around mobility, the last of all the tactical-gap bridges it required was a supersiege weapon.

What of Atomic Energy?

And thus also today with atomic energy. Is the problem once again to be shrouded in a false light? It would seem so, for it appears that this novelty is being considered solely as a super V-2 and not as a possible enhancer of mobility.

Finally, all design starts in the mind. When will the military designer and organizer appreciate this and begin to think correctly? This, in the present Age of Warring States, is the supreme question which faces every great nation. It is *the* lesson of the rocket.

Coast Guard

What's Past Is Prologue

Experience Should Guide Us in the Unrestful Future

by
Bernard M. Baruch

"Bravery or resources will not overcome an enemy who has destroyed us"

MY experience in two world wars, the aftermaths, and the endeavors to make a lasting peace make me marvel at the regularity with which errors are repeated.

At my first meeting with the then Under Secretary of War, Robert Patterson, he asked: "Why is it that we don't start off where we finished in the last war? Why don't we adopt what was learned?" Later, the Under Secretary of the Navy and others propounded the same question.

They may have had in mind, among other things, an outline of action that we drew up at the War Industries Board covering America's participation in the first World War. I sent it to President Wilson, and he accepted it as the mandate for the Nation's existence. It is as true today as it was on November 10, 1918—thirty years ago. Time has tested the formula and found it good. It will be equally true of our next war, which the fates forbid. It read as follows:

Outline of Action

"Wars are fought and won—or lost—on the land, on the water, in the air, and on those battle lines behind the front where the civilian forces stand.

"It is not enough to mobilize the Nation's military strength. There must be a mobilization of her full economic resources—industrial, agricultural, and financial. These must be organized, coordinated, and directed with the same strategy that governs the operations of the purely military arms of service.

"The prodigious strain upon the world's productive capacity must be met and balanced to provide the means of warfare and to maintain the civilian population as well as to preserve the economic fabric.

"To control and regulate industry in all its direct and indirect relations to the war and to the Nation, the President has created the War Industries Board and placed the responsibility for its operation in the hands of the chairman. . . .

"It is not only the duty of the War Industries Board to stimulate and expand production in those industries making war essentials; it is equally the Board's duty to protect, as far as may be, those industries not immediately essential to the war program.

"The War Industries Board is a method of control devised by the President to equalize the strain placed upon the American industrial structure by the war.

"Further, the Board regulates all and controls certain other industries of first-rate war importance; it fixes prices through the price-fixing committee; it creates new and converts old facilities; it clears the national business requirements; and it leads to conservation, which is needed to bridge the gap between the extraordinary demand and the available supply—a gap which exists in almost all the great commercial staples.

"The War Industries Board embraces all and each of the Nation. Food and fuel are separately administered, but with every other article of military need and of ordinary life the Board has a direct connection, and it has a basic relationship with food and fuel, too, for both require in production and distribution the materials that the War Industries Board provides. Its strength lies in the full and patriotic coöperation that American business, including both the employers and employees, gives in working out the problems common to us all.

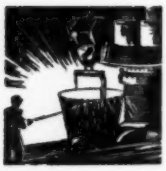
"The abnormal conditions of the war demand sacrifices. It is the price of victory. Only actual needs, not fancied wants, should and can be satisfied. To save heavy and long privation, temporary deprivation must be the rule. America's willingness to accept these conditions marks her ability to quicken the end of the conflict."

Despite all the foregoing learned in World War I, many of the same mistakes were made over again in World

This article is based on an address delivered by Mr. Baruch before the Industrial College of the Armed Forces, Washington, D. C.

War II. Faltering step by faltering step, we moved toward controls, but those controls were never sufficient and far-reaching enough. If they had been applied immediately, many lives would have been spared, our casualties lowered, and billions saved.

Also, as a result of piecemeal price control, we are now faced with inflation which, next to human slaughter, maiming, and destruction, is the worst consequence of war. It creates lack of confidence of men in themselves and in their Government. If, from the beginning, there had been an effective, over-all price-control law including everything—regulation and control of all prices, wages, rents, and food—there would have been a quicker ending of the war, a lessened cost, and less dissatisfaction among all classes.



But, after having granted favors to one class, group after group fought for favors until we found ourselves upon economic stilts. Then restrictions were removed while peace was still distant. Although the shooting war is over, we are in the midst of a "cold war."

The armed forces had an M-day plan which would have saved precious lives and the wasted wealth, but they were not permitted to put it into effect. We were told this was a different kind of war, and none of that "old World War stuff" was wanted.

No Time To Improvise

We are now making plans again. We have studied the results of the last two wars. I would like to see definite plans and blueprints ready to be drawn out, as they were ready before, with a public better educated as to our total war needs. With the new instrumentalities of mass destruction we will not have time to improvise. Bravery or resources will not overcome an enemy who has destroyed us.

War preparations must be governed by a desire for peace and security. The armed services today have to be versed not alone in war but in government, politics, the humanities—economic, social, and spiritual. We know our country has no will for war; it has the will for peace. Thus, preparedness takes on the symbol of peace.

Here is the minimum program that should be placed upon the statute books, ready to function, should war come:

1. Mobilize the full might of America—militarily, economically, and spiritually.

2. Have universal military training.

3. Have all men and women subject to mobilization with a work-or-fight clause. The same applies to every profession, science, calling, craft, industrial and agricultural effort, including labor of all kinds. In other words there should be a pool of all our man power—brains and brawn—ready to be tapped at any moment for war purposes.

4. Have an industrial plan ready to go into effect with full control of production, distribution, and prices, with the power of allocation, priority, and even exclusion for everything. The wisdom with which we organize our resources—men, money, and materials—will make winning morale.

5. Take the unfair profits out of war and prevent inflation through an over-all price-regulation, tax, and savings program. There must be only enough profit to keep our economy and production going. That cannot be done by favoring any one segment of our society.

6. While we must keep our civilian structure alive, skeletonize by restricting materials and man power for unnecessary wants. In the last war too much went for wants rather than needs.

7. Have an organization to export materials in demand by other nations and to buy the things our Nation needs or desires to keep from enemy hands.

8. Accumulate critical imports.

9. Retain war plants, particularly synthetic-rubber plants.

10. Intensify scientific research.

11. Have a standard form of contract set up now.

12. Have an Intelligence Service enlarged far beyond what now exists.

13. See that information and propaganda are organized, gone over, and continually improved to be ready when action demands.

14. Until some effective international guarantee of security has been established or resort to war eliminated, we cannot disregard the dangers inherent in developing mass housing in cities. Surveys must be made of underground industrial establishments, refuge for civilians, and dispersal of populations.

15. These organizations should be planned in considerable detail and gone over every three or six months by the National Resources Board. Competent men should be trained to fill the key positions. The Chiefs of Staff should make recommendations to the Resources Board for such changes as they deem wise and necessary. Setting up of industrial and social machinery should not be left until M-day.

16. All organizations should be continually in contact with the proper Congressional committees, keeping them in touch with defense plans. The American people must be taken into the fullest confidence. They will do anything required of them if they are told why. Do not try to fool them.

Universal military training must be regarded as the apex of a pyramid grounded upon the broad bases I have outlined above. It has neither purpose nor effect except as part of such a structure. To believe that our national security can be assured through universal military training alone is to deceive ourselves and to waste the precious time of our youth. Only if combined with a sound and comprehensive program for our national security can it be really effective.

Hemispheric Training

And I stand with the Secretaries of State, War, and Navy and the Chiefs of Staff of both services in favoring uniform hemispheric training and armament. We should make South, Central, and North America a complete unit.

We face a future that is unrestful but not alarming. I see no war with Russia as an immediate threat. With others of my countrymen, I feel deep irritations, but I do not fear explosions.

We have been just and generous, but there has been a lack of coöperation on the part of those whose friendship we solicit. Perhaps they expect our economic collapse. If so, they will be disappointed. We shall continue long after their experiment has failed.

We dedicate ourselves to the individual. The others elevate the State into a godhead.

But in the cold war that is being waged against us we must always remember that their objective is our unrest. We can guard against that by a firm belief in ourselves, under the magnificent flowering of our century and a half of national life.

We resent the continued efforts of Russian sympathizers to change our system of government and life. But we can make ourselves secure against their machinations by bettering our conditions. That, we are doing, slowly but surely.

Tracer Technology

Pyrotechnic Research Produced Tracer Ammunition of Great Reliability

by

Herbert E. Hirschland and Saul Ricklin

IN ORDER to be accurate consistently, it is necessary for a gunner either to observe the fall of his shots or to be able to see the flight of the missiles on their way to the target. Since it is impossible to see the effect of small-caliber fire at any great distance, the only alternative is a projectile that provides a luminous trajectory. Tracer ammunition was developed to fulfill this need.

The purpose of a tracer is twofold. First, it provides a visible means of following the trajectory of a projectile from the muzzle of a gun to the target, thereby serving as a ranging guide. Secondly, in shells loaded with high-explosive charges, as distinguished from armor-piercing or incendiary shells, the tracer also serves as a means of exploding the shell in flight at a fixed time after it leaves the gun, thus serving as a fixed-time fuze.

The need for this is obvious when one considers that in antiaircraft fire the angle of fire is very steep and a very high percentage of the shells which do not hit a target would fall to the ground and explode among friendly troops.

It is, therefore, necessary to explode these shells by means other than the nose contact fuze. Moreover, a shell which can be exploded near a target can cause damage by means of flying fragments.

Pyrotechnic Compositions

Both the above main requirements are fulfilled by several types of pyrotechnic compositions which are pressed into variously designed tracer cavities in the base of projectiles. Failures of the tracer elements to perform can cause many types of malfunctioning, as will be outlined later.

The visible tracer is produced by the emission of flame and incandescent matter from the pyrotechnic composition. At times, however, when a visible trace is not needed but the time-fuze effect is desired, a nonluminous or a "dark tracer" is used. This is simply a nonluminous pyrotechnic composition.

In order to activate the tracer, an igniting composition is pressed over the pyrotechnic. In the so-called "direct-ignition tracers" this composition is ignited by the flash of the propellent powder in the gun barrel.

"Dark Ignition"

The usual ignition composition burns rapidly with a bright flash. Again, special field requirements make it desirable, at times, for this flash to be eliminated and for the tracing action to start at some specified distance from the gun. Ignition of this type is known as "delay," "dark," or "dim" ignition.

The tracers are always situated at the base of the projectiles and are either housed in a cavity in the shell (internal tracers) or protrude from the base (external tracers). The cavity may be part of the shell itself or it may be in a tracer body which, in turn, is fitted into a cavity in the shell.

The development of tracer compositions calls for materials which will meet the following requirements:

1. Light Intensity.—Except for special requirements, it is desirable to have as intense a light emission as possible in order to get maximum visibility.

2. Color.—A color must be developed which permits maximum visibility and allows for the spectral sensitivity of the eye, absorption by the atmosphere of different wave lengths under various conditions, and psycho-physiological factors, such as contrast, must be developed. For this, the most commonly used color has been red.

3. Burning Time.—The tracer should burn long enough to permit observation to the target, and if used in self-destroying shells, must burn consistently to the time set.

4. Ignitability.—The igniter composition must be readily ignited by the flash of the propellent powder. In turn, the tracer composition must be easily ignited by the igniter composition, but it

Mr. Hirschland is a development engineer and Mr. Ricklin is a research engineer, both on the technical staff of Metal & Thermit Corporation, New York City.

must not be ignitable by any propellent powder gases which may penetrate it at the instant of firing.

5. Resistance to Blowouts and Prematures.—The tracer composition must resist the malfunction known as a "blowout" in which the pyrotechnic is ejected *en masse* from its cavity shortly after leaving the muzzle of the gun. This may or may not be accompanied by premature self-destruction. In either case, casualties to gun crews or friendly ground troops can occur.

6. Chemical Stability.—The pyrotechnic must be chemically stable under cyclic conditions of high temperature and humidity and must be nonreactive with the igniter composition at the igniter-tracer interface.

7. Consolidation.—The tracer composition should be capable of performing satisfactorily when consolidated at the lowest pressure possible. The use of low pressures makes the use of thinner-walled tracer bodies possible which thereby permits the use of more tracer composition in the same total volume with consequent greater visibility.

8. Pelletability.—The composition must be easily pelletable since tracers are often pelleted for ease of handling in manufacture.

9. Sensitivity.—The pyrotechnic should be insensitive enough to impact and friction to permit safe handling in the plant. It must also be nontoxic.

10. Flowability.—The composition should have enough flowability to permit the use of automatic pelleting presses with hopper feeds.

Tracer pyrotechnics are usually made up of an oxidizing agent, a metallic reducing agent, and an organic binder. The most common reducing agent is magnesium used as a powder varying from 100 mesh size down through 325 mesh. Occasionally aluminum, calcium-silicon, magnesium-aluminum, or other metals are used, but these usually do not succeed in giving enough visibility.

Organic Binders

Organic materials are added as binders to control burning time and to give other performance characteristics. Some of those used are linseed oil, asphaltum, carnauba wax, shellac, and calcium resinate.

The igniter compositions follow the same general pattern, using magnesium and sometimes aluminum as the reducing agent. The most common oxidizing agent is BaO_2 since the Mg-BaO_2 compositions are highly ignitable. Other oxidizing agents used are strontium peroxide, barium nitrate, barium chromate, etc.

Mixing

Both tracer and igniter pyrotechnics are made completely of finely divided materials and these are usually mixed intimately in the dry state in double cone mixers. Occasionally wet mixing is used with binders such as ethyl cellulose in alcohol, calcium resinate in carbon tetrachloride, or linseed oil alone.

After mixing, the compositions are usually pelleted in automatic pelleting presses at pressures of 10,000 to 30,000 psi. The pellets are then loaded into the tracer cavity and compressed in several increments at pressures ranging from 70,000 to 110,000 psi.

The usual bright igniter used in tracers is effective as a means of transferring ignition to tracer pyrotechnics, but it does have certain disadvantages because of its brightness. These disadvantages are, first, the nighttime illumination of the gun area by the flash of the igniter which discloses the position to the enemy, and, secondly, the "blinding" of the gunner with attendant decrease in accuracy.

The illumination is, of course, negligible in the daylight and is also of secondary importance at night if the smokeless powder itself has a bright flash. "Blinding" of gunners varies in importance with the type of gun, method of firing, etc. In order to eliminate these disadvantages there has, from time to time, been a requirement for either dark or dim ignition. Dark igniters are those which are completely invisible even at night so that the first visible tracer light appears at some distance from the gun.

While such an igniter would solve both the problem of gun illumination and blinding flashes, it has the disadvantage of making it difficult to pick up the path of the tracer in daylight. With a completely dark igniter, the gunner also finds it difficult to follow his own tracer even at nighttime if there is a maze of cross fire. In order to meet this difficulty, it has been necessary to compromise in some cases by changing the requirements to dim ignition.

A dim igniter is one which exhibits a dim streak from the gun muzzle to the point where the tracer pyrotechnic takes over, without having any flash or area illumination. This type of igniter solves the problem of gun illumination, does not blind the gunner, and makes it easier to follow the path of the tracer at night, but it is usually invisible in the daytime.

The question of stability is of the utmost importance in tracer technology and has been one of the most difficult problems. In order to obtain good ignitability and the high temperature needed for visibility, it is necessary to use pyrotechnic materials which are usually very reactive with each other and tend to decompose at high temperatures and high humidities.

Since tracer ammunition is used in all theaters of war, it is often exposed to temperatures as high as 125-135 degrees Fahrenheit and humidities of 95 to 100 per cent. Hot days and cool nights, as they occur in the tropics, tend to produce "breathing" cycles in the ammunition which accelerate decomposition.

Since the igniter composition is on top of the tracer composition, it is apt to be the first attacked. Unfortunately, decomposition of the top layer can produce complete failure of the tracer, since a small amount of decomposition quickly affects ignitability.

Although the tracer pyrotechnic is fairly well protected by the igniter composition, the question of its stability is an important one. Poor stability may lead to failure to light up, failure to continue burning, variations in burning time, dimness and loss of color, failure to destroy itself, etc.

Sealing Tracers

A good deal of attention has been paid to the sealing of tracers by mechanical means to keep out moisture, and considerable success has been obtained. These seals are not perfect, however, and they are no protection against high temperatures. One limitation in the design of mechanical seals lies in the fact that the seal must permit ignition of the top layer of composition.

Attempts to improve the stability of igniters by changes in composition involve the substitution of less reactive metals for the commonly used magnesium, changes in particle size and shape, surface treatments, use of nonhygroscopic oxidizing agents and use of protective organic binders.

U. S. Navy

Mysteries of Naval Ordnance

Luck and Brains Helped Solve Some Baffling Accidents

Many years sometimes elapsed before long memories, keen observations, and new testing techniques found the answers to freakish mishaps.

by

Rear Adm. G. L. Schuyler

WHEN something goes seriously wrong with naval ordnance material immediate diagnosis is often impossible, and those responsible for corrective measures may find themselves in difficult positions and subject to severe undeserved criticisms. Usually, but not always, the mystery is solved; but often much too late for the comfort of those initially involved. To discourage intolerance and to give a better insight, let us consider the following cases:

Losses of gun muzzles.—About forty years ago guns using smokeless powder were introduced into the Navy. Designers carefully computed higher muzzle pressures for the new propellant. They used on muzzle sections of these longer guns the same 1.4 factor of safety of previous designs; but a large number blew off their muzzles.

Designers eliminated this trouble by using muzzle factors of safety of 2.0 or more, then spent years unsuccessfully trying to find why this was necessary. There was nothing wrong with the metal, strength calculations, or pressure-gage techniques. Pressure gages in holes piercing the guns showed gas pressures at the muzzle properly estimated.

The designers died without knowing why extra factors of safety proved necessary on muzzles of long guns. The service considered them blunderers with uninteresting "alibis." Their successors found larger muzzle factors of safety well established, wondered at the stupidity of smaller values, and smugly and successfully applied the technique they did not have to learn the long, hard way.

Admiral Schuyler, who retired from the Navy early this year, was assigned to the Navy Bureau of Ordnance in 1909, two years after his graduation from the Naval Academy. He was the first American naval officer to be sent to study at a university and the first to be assigned exclusively to engineering duty. During his career he commanded the Naval Powder Factory at Indian Head, Md., and the Naval Proving Ground at Dahlgren, Va.

Admiral Schuyler organized and headed the Research and Development Division of the Bureau of Ordnance and was an observer at the atomic bomb tests at Bikini. He was awarded the Navy Cross in World War I, during which he commanded a naval railway battery in France, and the Legion of Merit in World War II for his outstanding services.—THE EDITORS.

The answer was found only recently when electric strain gages showed local pressures over rotating bands of projectiles as they travel down the bore often are nearly equivalent to the gas pressures at the muzzles (though of course much less than gas pressures near the breech). The need for higher factors of safety at the muzzle thus became apparent. But measurements of band pressures required electronic devices which appeared a generation after the affair was largely forgotten!

Excessive patterns of 14-inch, 50-caliber guns.—These guns all ranged well at eight degrees' elevation at Indian Head but on shipboard developed entirely excessive patterns. All suspected causes were investigated. Operating personnel insisted that the projectiles were too vigorously rammed for them to become unseated, but unseating eventually proved to be the trouble. The charges were about eighteen inches shorter than the powder chambers, and when projectiles slipped back this distance (as about one-third did at over twelve degrees' elevation) they overshot range tables much more than was possible in guns where charges nearly fill the powder chambers.

The guns had an extremely steep band-seat slope conducive to seating failures. With drill projectiles, repeated ramming mashed down rotating bands so that projectiles did not unseat. But target projectiles were rammed only once, so rotating bands did not stick, and at above twelve degrees' elevation the projectiles slid back. Once diagnosed, a very simple remedy was immediately effective.

The COLORADO'S 5-inch, 25-caliber gun explosion.—An antiaircraft projectile burst its gun on the COLORADO and killed most of the gun crew. Test firings were made with fuzes specially weakened, parts removed or misassembled, and time settings on zero. But no prematures occurred nor were there any when projectile walls were reduced to half thickness and improper loadings simulated. About 6,000 of the 5-inch antiaircraft projectiles were then selected at random and were examined for soundness of metal. In the absence of better ideas, fuzes and fuze setters were modified to prevent zero settings. No further accidents occurred, but, in view of the great number of rounds fired previously without accident, this was no proof of a "remedy."

Ten years later, when TNT was melted out of a similar projectile, a tiny stream of water was seen coming out of the base. In this and a few other projectiles tiny holes perforating somewhat unsound bases were discovered. By drilling similar holes in bases of test projectiles the COLORADO's accident was duplicated and explained.

It would have remained forever a mystery except for the merest chance and an intelligent report of abnormal behavior ten years later.

The 40-mm. loading accidents.—No accidents occurred during the first year that 40-mm. guns and ammunition were produced. However, shortly after extensive use began, there were occasional rounds which fired prematurely on being "catapulted" into guns by their loading mechanisms.

Though accidents were numerous, their frequency was extremely low, being only about one in the same number of rounds as had been fired without accident on all acceptance tests. Accidents were scattered throughout all production so that the withdrawal of specific lots would probably have been futile. A lucky diagnosis was that, in handling and shipment, the primer mixture sometimes broke up and sifted in such a way as to make primers supersensitive. It was possible to duplicate the accident by catapulting the same round some dozens of times; and a modification which withstood such treatment cured the trouble.

This testing method suggested itself when an officer remembered that thirty years earlier a primer fired when inserted in a 14-inch gun by a magazine lock (of a type later withdrawn from service) because the crew had loaded it repeatedly "to verify it was not supersensitive."

Explosions of bomb-type ammunition by rough handling.—Such accidents usually leave no witnesses nor evidence. With fuze action not positively ruled out, accidental fuze action was usually featured as the probable or only possible cause. But early in the war there were accidents which forced the conclusion that such explosions frequently result (even with fuzes present) from impacts sufficiently severe to dent, but not rupture, the thin-walled metal containers.

The phenomenon differed essentially from that involved in any standard laboratory tests. For this action the container must be thin enough to permit local ignition yet thick enough to afford considerable confinement before rupture. Very peculiar types of impact are required; for otherwise, considering the usual evidences of denting, explosions of this sort would be very frequent.

Factual information was obtained by a strange accident which nearly escaped special notice.

An airplane on the ground inadvertently released a TNT-loaded depth bomb so that after an 18-inch fall it hit the rounded corner of a trailer-truck under it. A small part of the explosive burst open the case. Boosters and exploders were intact. No seam, in which explosive might possibly have been "pinched" by the blow was involved.

An experimental rig was devised in which, by special impacts, occasional high-order detonations of various explosives with thin metal covers were eventually obtained and the true mechanisms of these accidents thus revealed. Handling techniques were modified (forbidding use of cargo nets and requiring tray loading for bomb-type ammunition), and it is believed this prevented many accidents. Improvements in "container-dent sensitivity" of modified RDX explosives were verified by this testing technique. In diagnosing ordnance troubles one must be sure that no "experimental data" of importance escapes notice because included only in inconspicuous routine reports.

Bore prematures due to missing tracers.—During the war there were a very few 5-inch antiaircraft bore prematures. From design characteristics it seemed impossible that fuzes were guilty, but nevertheless fuzes were replaced by others working on an entirely different principle. But still the trouble continued.

An officer recollected that a few years previously some 5-inch ammunition was turned in with a few loose and missing tracers. Projectiles with inert loading and with tracers removed were fired into sand and recovered. In one or two the gas pressure, entering the empty cavity for the tracer, had broken through the wall and reached the filler.

The reason for these prematures was thus disclosed after four years of disheartening investigation throughout which it was improperly assumed that tracers "naturally" would be in place,

U. S. Navy

Five years of constant investigation and experiment were needed to remedy the erratic performance of 14-inch, 50-caliber guns like those shown blasting the enemy.

because there was only this single contrary report which one officer remembered.

Troubles with torpedo exploders and with torpedoes running too deep.—Submarine personnel normally would not criticize torpedo exploders unless the average percentage of apparent misses was unexpectedly large. But with U. S. torpedoes this was not the case, and only a few statistically unsupported rumors threw suspicion upon exploder performances during the first part of the war.

Investigation showed that more severe impact reduced the reliability of torpedo exploders and indicated that some percentage, fortunately extremely low, had probably failed when torpedoes, running at high speeds with nearly normal impacts, struck enemy targets at frames and other places where hull plating was doubled. A new type of exploder was therefore developed.

Operating forces meanwhile conducted experiments of their own. They also determined the trouble and modified existing exploders pending the arrival of the new type.

With the exploders which gave the trouble the spring-actuated firing pins moved vertically at right angles to the deceleration so that, with very severe impacts, the firing pin did not fire the cap before its motion was limited by friction or by deformation of its guides. Unfortunately, during development tests none of the impacts were severe enough to cause a malfunction.

Operating forces then reported the necessity of using shallower depth settings to make torpedoes run at desired depths. Torpedoes returned from ships and fired through nets ran deeper than depth recorders indicated. Originally running depths were determined by nets. After World War I depth recorders, carried in the war heads, were procured. They gave readings checking with depths determined by running all torpedoes of that period through nets. They also were more convenient and indicated depth as a continuous function of distance run.

The use of nets was discontinued; but later torpedoes ran faster, had different head shapes, more negative buoyancy, increased trim angle, were proved with exercise heads lighter than war heads, had inlets to recorders differently located, etc. In retrospect, it is not difficult to see that checks of depth-recorder readings against depths by nets should not have been omitted with these later torpedoes. This does not cover all troubles encountered with U. S. torpedoes but illustrates how seemingly trivial oversights can cause puzzling performances.

Static ignitions of powder charges.—In 1910 a powder tank transferred to a lighter from the U.S.S. CULGOA exploded when laid down. The Joint Powder Board, after investigating for one year, ascribed it to "some obscure undetermined cause" like the presence of a match. During World War II after more such powder fires it was determined that powder tanks may contain explosive air-ether mixtures. Electrical charges are generated by friction of silk powder bags against interior of tanks when tanks are improperly rolled. This will charge a condenser, comprising end of tank, end of bag, and ignition charge (in which graphite on grains is a conductor). The spark occurs when, as in upending a tank, the ignition charge is separated from contact with the end of the tank. Adequate corrective measures have now been taken.

It is interesting to note that in 1910 the Board's report showed it considered static electricity a possible cause until the laboratory reported inability to produce significant voltage by bag friction. It is clear from the laboratory report that an unsuitable instrument and an improper circuit were used. Diagnosis was delayed thirty-five years; so one must consider the disagreeable possibility of misleading findings if one reads only laboratory conclusions and skips details of experiments.

U. S. Navy

Shells sometimes fired prematurely upon entering 40-mm. guns such as those above. It was found that the primers became supersensitive because of excessive handling.

For Modern Military Transport

A Plan for Subsidizing Motor Truck Production

Col. C. Elford Smith

The use of military vehicles instead of commercial types by Federal and State governments would equip the United States with an up-to-date motor fleet ready for instant use in emergency

THE Army knows what types of motor vehicles it wants. Industry can make them. But the problem is how to produce a large fleet of the vehicles in a practical peacetime manner.

The answer is: To have Federal agencies, State highway departments, and private contractors on Federal projects use military-type vehicles instead of commercial vehicles, the *difference* in cost of building and operating them to be subsidized with War Department funds. The obvious yield of this plan is peacetime work done with national-defense equipment.

This form of a military subsidy is not new. Before World War II the Navy subsidized the building of faster oil tankers than commercially profitable. These tankers, built under the Merchant Marine Act of 1936, "joined" the Navy after Pearl Harbor and earned a "well done." Other examples are the Post Office air-mail contracts in the early days of aviation and, more recently, the T.V.A. whose generators developed a large part of the electricity needed to produce the atom bomb.

A subsidy can be applied in the case of motor vehicles for the Army, because Federal and State agencies operate vehicles under off-the-road conditions similar to military requirements. In fact, a jeep-type vehicle is now being used by the Forestry Service in riding fire trails and making repairs on trails and fire breaks. This same agency could also use the all-wheel-drive ¾-ton, 2½-ton, and 5-ton trucks for forest fire fighting and other heavy work.

The Soil Conservation Service would find the jeep helpful in rapidly surveying large fields to gauge soil erosion, and the larger vehicles would be useful for heavier work.

The Post Office Department could use the light 4-wheel-drive jobs to mount the rural mail carriers who have routes over rugged country.

State highway departments would find the all-wheel-drive heavy vehicles excellent for snow removal and material handling for road repairs and construction. Private contractors on Federal construction projects could be furnished military-type vehicles as part of the contract payment. This would develop "special" military vehicles.

Why not use these thousands of ton-miles of off-the-road operation to develop and keep military transport up to date? A War Department subsidy would do it and at the same time provide advantages to the national defense, the taxpayers, the vehicle users, and the automotive manufacturers.

Motor Transport "In Being"

Such a claim seems utopian, but it isn't, for the plan would promote national security by keeping *in being* and in operation a large fleet of up-to-date military vehicles available for instant use. This is extremely important, as America is now the first target of any major aggressor because America has twice thwarted plans for world enslavement. Therefore, we will not have the time to equip our man power that we had in World Wars I and II.

The size of this "subsidized" fleet could be considerable as there are 239,902 automotive units in use by Federal and State agencies. If only 40,000 should be "subsidized" each year with the latest military model, a fleet of 200,000 would be available in five years. This fleet would equip a striking force.

Colonel Smith is chief of the Automotive Division, Development and Proof Services, Aberdeen Proving Ground, Md.

Tax Saving

As to the taxpayer, his dollar would do double duty. It would support national security and buy vehicles useful in peacetime to work for the Nation.

The advantage to the users is that a vehicle with the off-the-road ability of a military type would widen the scope of work done over that possible with the commercial vehicles used by Federal and public agencies.

It is reasonable to suppose that the manufacturers with major automotive production facilities will coöperate in such a plan as this. There already is a strong indication that the General Motors Company is willing to support such a plan, for Alfred P. Sloan stated in a recent article that "General Motors stands ready to do its part in support of any constructive or equitable plan of action that contemplates maintaining in peace as well as in war a high technical standard of defense equipment."

The proposed plan is "constructive" and "equitable" because manufacturers will not be requested to produce a few pilot models at a possible loss but rather will be given an opportunity to produce thousands of "subsidized" vehicles at a possible profit.

Synthetic Rubber Aid

In addition to the benefits already cited, the plan has an added advantage in keeping alive the declining synthetic-rubber industry. It has been estimated that 40,000 tons of synthetics annually could be used in tires for the "subsidized" fleet.

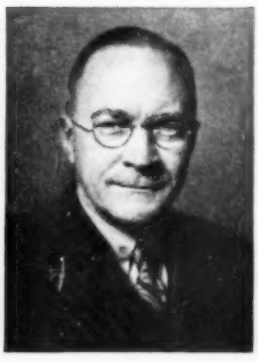
Another probable benefit would be that the plan for hemisphere defense would undoubtedly be forwarded if the public works agencies of the North and South American countries were provided with standard military vehicles.

What can be done now to start this plan? (1) Acceptance of the plan by all concerned; (2) Legislation modifying the Merchant Marine Act of 1936 to cover the new requirements; (3) Use of the present stock of military vehicles to start the program.

For Eminent Service We Salute These Industry-Ordnance Leaders

M. H. Eisenhart

Rear Adm. F. E. Beatty



T. R. Jones

Capt. H. E. Saunders

E. C. Morris

M. Herbert Eisenhart is president and general manager of Bausch & Lomb Optical Company, Rochester, N. Y. A leader in civic and industrial affairs, he has led his great organization in the design and production of superior optical instruments for the armed services and the civilian economy.

Rear Adm. Frank E. Beatty, U.S.N., is commanding officer of the Naval Ordnance Laboratory, White Oak, Md. He commanded the U.S.S. COLUMBIA in the naval offensives in the South Pacific, 1943-1944, and later commanded the destroyers of the Atlantic Fleet. He is directing the Naval Ordnance Laboratory which is now rapidly nearing completion.

Thomas R. Jones, president, American Type Founders, Elizabeth, N. J., helped achieve ordnance production in World Wars I and II. In the first conflict he served as an Army coördinator on the War Industries Board; in the second, he directed with outstanding success the operations of ATF in the production of radar, rockets, guns, and recoil mechanisms.

Capt. Harold E. Saunders, U.S.N., is director of the David W. Taylor Model Basin at Carderock, Md. With the exception of two years spent at sea and a year in the Navy Department he has devoted his talents to the operation of model basins at Washington and at Carderock since 1929. He is an expert in the design of submarines.

Ernest C. Morris recently completed forty-eight years of service in the Office of the Chief of Ordnance in Washington. He acquired exhaustive knowledge of all phases of storage and issue of heavy artillery and fire control.

Col. Henry T. Bodman, member of the board of directors, Reconstruction Finance Corporation, Washington, D. C., did yeoman work for industrial mobilization in the organization of the Office of Production Management, predecessor to the WPB. He served on the staff of the Chief of Ordnance, U. S. Army, 1942-1945.

Col. D. K. Bullens, an Ordnance Reserve officer, has served the Ordnance cause faithfully and well for many years. He is president of the New England Auto Products Corporation, Pottstown, Pa., and is an active member of the advisory board of the Philadelphia Ordnance District.

Rear Adm. T. D. Ruddock, U.S.N., is superintendent of the U. S. Naval Gun Factory at Washington, D. C. He was formerly Assistant Chief of the Navy Bureau of Ordnance. He has filled important assignments on land and sea and has contributed greatly to the advancement of U. S. naval ordnance.

J. Carlton Ward, Jr., has been president of Fairchild Engine & Airplane Corporation since 1940. He has had a long and distinguished background in aviation and industry. He was the first to testify before Congress on the necessity for exploring the possible use of atomic energy for the propulsion of aircraft during testimony before the Mitchell Committee of the Senate shortly after the use of atomic bombs on Japan. As a result, Mr. Ward was chosen to direct the AAF contract to carry out the development of nuclear energy for the propulsion of aircraft.

R. Smith Payne, Alabama Textile Products Corporation, Andalusia, Ala., has had a long and distinguished career as an industrial engineer. In World War I he helped produce guncotton. In World War II he managed the Utah and Denver Ordnance plants.

Col. H. T. Bodman

Col. D. K. Bullens

Rear Adm. T. D. Ruddock

J. Carlton Ward, Jr.

R. S. Payne

High Explosive Bombs

American Industry Had the Capacity To Make Them in Astronomical Numbers

by

H. S. Beckman

Manufacturers' peacetime "know-how" gained in producing consumer goods enabled them to change over their plants without undue difficulty.

THE Joint Aircraft Committee, consisting of representatives of the War Department, Navy Department, War Production Board, the President's Liaison Committee, and the British Supply Council, assigned the sole responsibility for the development and procurement of general-purpose (G.P.), semiarmor-piercing (S.A.P.), and fragmentation bombs to the Ordnance Department during World War II.

These constituted the major part of the bombs used during the war. Aërial mines, depth bombs, and armor-piercing bombs were assigned to the Navy Department, and incendiary bombs were retained by the Chemical Warfare Service.

To avoid duplication of effort, the Ordnance Department also procured for the Chemical Warfare Service all the components (except loading) for 100-pound and 500-pound incendiary bombs because these were either the same as, or similar to, bombs for which the Ordnance Department was responsible.

Millions of Bombs

Just a few years prior to the war the Ordnance Department was placing orders for eighty-three 2,000-pound bombs, one hundred and twenty-seven 1,100-pound bombs, and one thousand 600-pound bombs, with long time limits for completion. Compare these figures with the 25 million general-purpose bombs (Fig. 1), weighing 100 to 2,000 pounds, the 75 million fragmentation bombs (Fig. 2), weighing 4 to 260 pounds, and the large quantities of other types, including 12,000-pound bombs, procured by the Ordnance Department during the war.

This accomplishment becomes even more outstanding when we consider that of the scores of manufacturers who fabricated bombs during the war, only two had actually produced bombs in peacetime.

The experience gained in peacetime production of consumer goods in general guided each manufacturer in the selection of the method of fabrication of G.P. and S.A.P. bombs. Thus, in shops where steel bottles had been spun, spinning was adopted for forming the nose and tail section of the bombs. In the factories where wobblers had been used for forming flanges on pipes, wobblers were adopted for forming bombs. In hammer shops, swaging was adopted.

The Ordnance Department did not specify the method of fabrication but prescribed only the mimimum physical properties for general-purpose and semi-armor-piercing bombs and final dimensions and materials for other types.

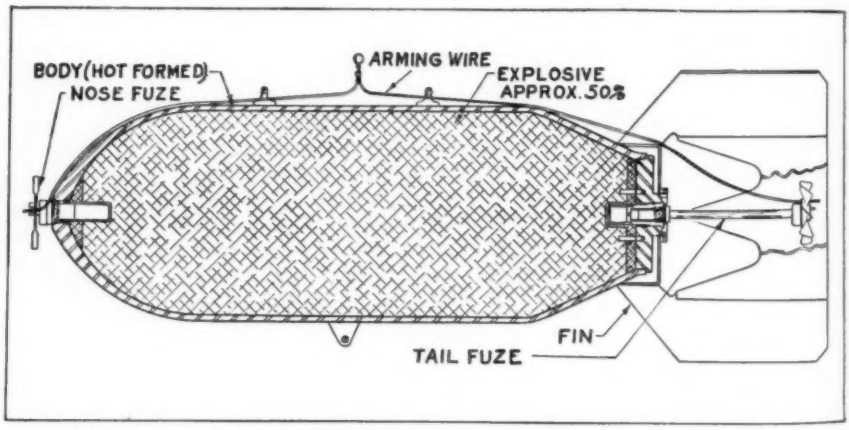


Fig. 1. This is a typical general-purpose bomb with fuzes in nose and tail.

Mr. Beckman is associated with the Ammunition Branch, Research and Development Division, Ordnance Department, U. S. Army.

Seamless or flash resistance welded tubes were used primarily in the fabrication of G.P. and S.A.P. bombs. Only one manufacturer used steel plate, which was heated and then formed into a cup and drawn by a ram through several ring dies so as to obtain the desired contour. The four other methods of "hot forming" these bombs are:

1. Hammering or repeated pressing at right angles to the tube axis. The tube is rotated and fed into the dies. The process is illustrated diagrammatically in Figure 3. The process is commonly known as swaging. Only the top die is movable. In a modification of this process, the tube is vertical and both dies move at forty-five degrees.

2. Axial press or hammer work with repeated strokes (two to twenty) of the die. From two to four different dies are used in succession to form the nose with multiple heating. A mandrel may be used. One die is usually sufficient to form the tail. Crank presses as well as hydraulic presses serve for this work. The process is illustrated in Figure 4.

3. Spinning. The tube with a heated end is clamped in a sleeve and is brought up to a high rotary speed (1,150 to 1,600 r.p.m.). A roll is brought in contact with the extreme hot end of the tube and is fed into the tube by axial and swinging motions until the desired shape is obtained. This process is shown in Figure 5.

4. Wobbling. A wobbling die is fed axially toward the heated end of the stationary tube and closes in the tube to form the required bomb contour. This process is illustrated in Figure 6.

Other operations required to complete the bomb body, in addition to cutting the tube to length and heating it, are heat-treating, lug welding, lug testing, shot blasting, machining of threads, degreasing, and painting.

Prior to World War II, bombs were loaded with high explosives at Savanna, Ogden, and Picatinny Arsenals. With the tremendous increase of bomb requirements, many additional Government-owned, privately operated loading plants were constructed.

At the beginning of the war, bombs were loaded with amatol (about fifty per cent TNT and fifty per cent ammonium nitrate) due to a shortage of TNT. Early in 1943 the supply of TNT in storage and that being manufactured had increased to the point where straight TNT could be used.

As a result of the development of more powerful explosives, in May 1943 the Ordnance Department began loading a large percentage of bombs with Composition B (60 per cent RDX and 40 per cent TNT) and in January 1945 with tritonal (80 per cent TNT and 20 per cent aluminum powder).

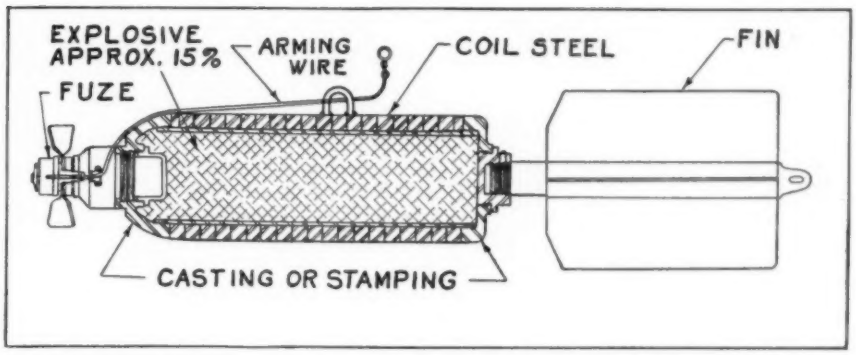


Fig. 2. Mass-production processes were easily applied to fragmentation bombs of this type.

Methods of Loading

The method of loading 500- to 4000-pound bombs with TNT is as follows: (1) Melt flaked or grained TNT in melt unit; (2) Draw off molten TNT into Dopp kettle; (3) Cool liquid TNT in Dopp kettle from a temperature of 196 degrees Fahrenheit to the pouring temperature of 176 degrees Fahrenheit by "feathering"—the addition of granular or flaked TNT; (4) Pour TNT into bomb body; (5) Allow bomb to cool for a period of twenty to thirty-six hours depending on its size; (6) Break down and submerge crust after cooling period and thoroughly mix the liquid TNT on top with the mushy TNT in the bomb nose; (7) Pack pellets (small chunks of cast TNT) into molten TNT, thereby "freezing" the charge.

It must be remembered that without fuzes bombs are worthless. For each of the millions of bombs produced, fuzes had to be procured by the Ordnance Department to accomplish the extensive missions of the Air Forces. These missions necessitated the use of fuzes which functioned either superquick or .01-second, .025-second, .10-second, 4 seconds, 8 seconds, and up to 144 hours after impact. In addition to these, mechanical time fuzes also were procured by the Ordnance Department and were primarily employed to separate clusters of fragmentation and incendiary bombs in the air.

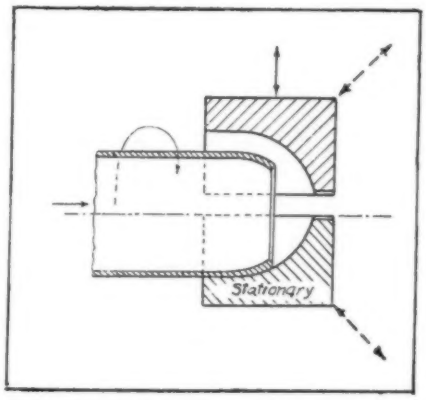


Figure 3 diagrams the swaging operation.

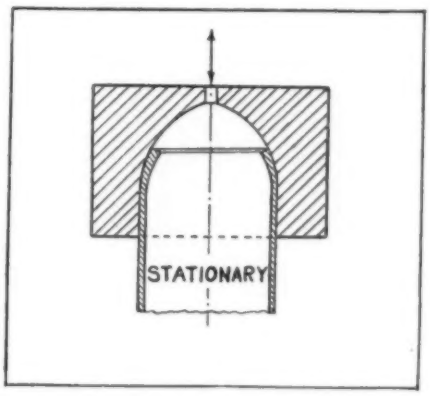


Figure 4 outlines axial-forging practice.

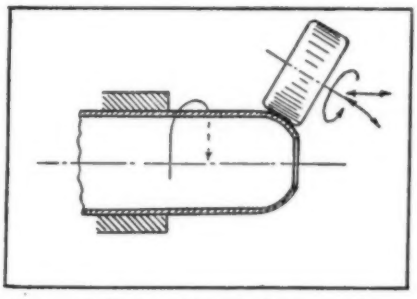


Figure 5 depicts the spinning procedure.

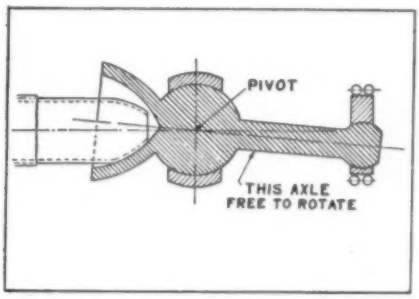


Figure 6—the wobbler forging method.

National Security Now!

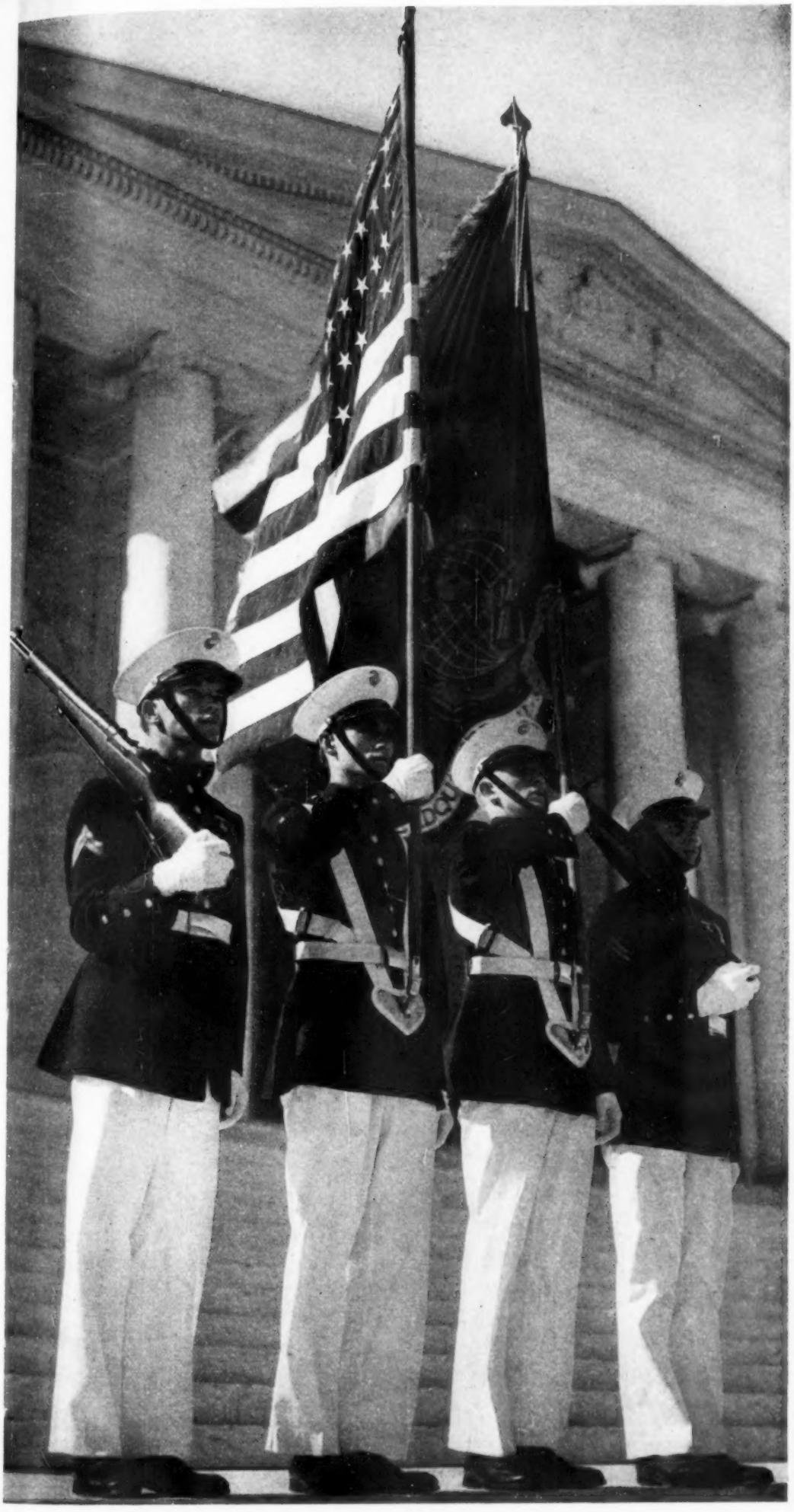
¶ This will be the theme of the Twenty-ninth Annual Meeting of the Army Ordnance Association, October 1 and 2, 1947. All members are cordially invited to attend all sessions of what bids fair to be a most historic occasion.

¶ The first session of the meeting—Wednesday, October 1st—will be held at the Waldorf-Astoria Hotel, New York City. Beginning at 10:00 A. M., there will be meetings and seminars of the various Divisions and Committees of the Association throughout the day. An Industrial Preparedness Luncheon will be held at 12:30 followed by further committee meetings and seminars.

¶ The Twenty-ninth Annual Dinner Meeting will be held in the Grand Ballroom of the Waldorf at 7:00 P. M. A galaxy of distinguished speakers—scientific, industrial, and military—led by Secretary of Defense James Forrestal, will address the various gatherings.

¶ The second session will be the traditional Ordnance Day at Aberdeen Proving Ground, Md., on Thursday, October 2nd, beginning at 10:00 A. M. Special trains will bring members from the New York session. At Aberdeen there will be a day-long program of demonstrations and exhibits emphasizing the place of the Science-Industry-Ordnance Team in guaranteeing national security now.

¶ Personal invitations and complete details have been sent to all members. Be sure to attend and do your part to keep America strong!



THE U. S. MARINES

The Marine Corps, which pioneered the science of modern amphibious warfare during the years before World War II, is again shaping its peacetime operations and training toward accomplishment of the fundamental rôles and missions of the Corps. In substance these are:

To continue development of amphibious tactics and techniques;

To carry out naval security duties ashore and afloat and to implement the policies of the United States abroad as required;

To maintain the Fleet Marine Force in readiness for service as a component part of the United States Fleet.

In implementation of these rôles and missions the Corps maintains supporting establishments at various major bases in the United States and its possessions. Here, as well as at sea and in the air, the Fleet Marine Force, a balanced amphibious expeditionary force embodying the combined arms, plus supporting air and logistic elements, conducts the training necessary to ensure that now, as in the past, the Marine Corps may continue to be distinguished by readiness, quality, and esprit.

GEN. A. A. VANDERGRIFT
Commandant, U. S. Marine Corps

This Marine marksman kneels to fire on the enemy in the Battle of Saipan, one of the bloodiest in Marine history.

Shown above, an amphibious tractor battalion forms into a line as the Leathernecks start the dash for the coast of Okinawa.

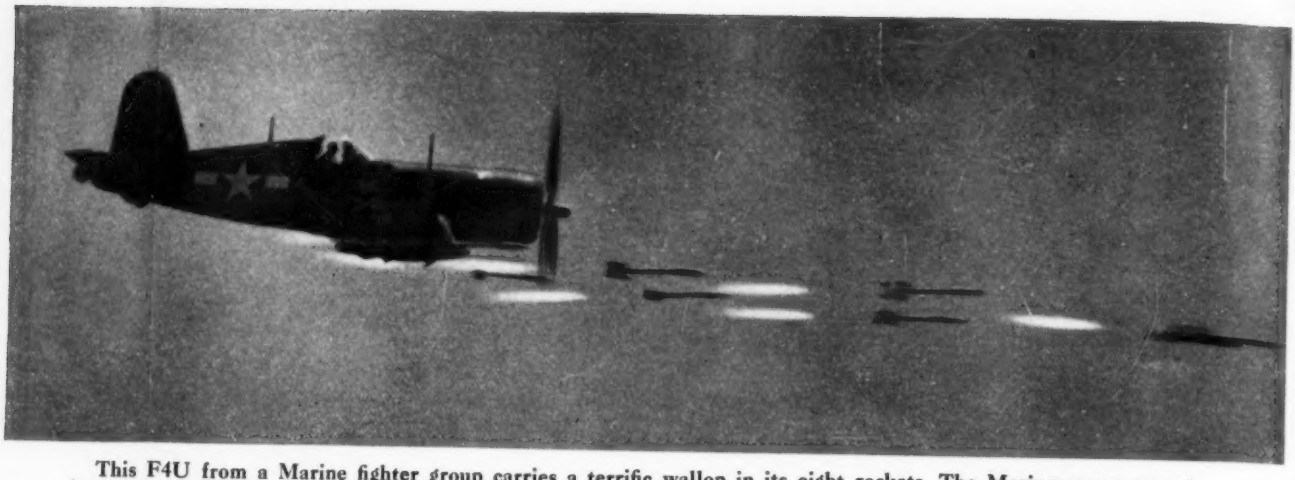
Marines, right, wade ashore to the Tinian beach to move on for the fighting inland. Vessels of the supporting force can be seen in the background just offshore.

Marines drive inland from a beachhead on Rendova, gaining the initial foothold from which the Japs could be overcome and neu defenses was the toughest combat job that faced the Leathernecks. Names such as Guadalcanal, Saipan, Tarawa, and Iwo Jima wi

One Marine, armed with a carbine, stands ready to make a dash forward with ammunition, while his partner throws a grenade at the Japs.

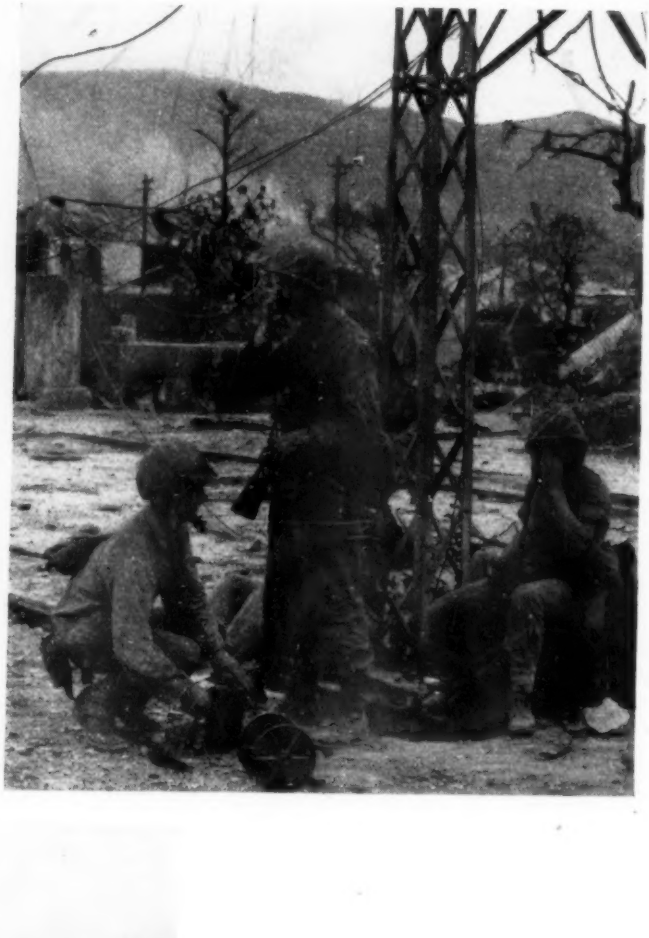
nd neutralized. Penetrating Japanese Pacific island Jima will remain as monuments to Marine courage.

Marines hitting the beach at Saipan, below, in the first wave crawl up on their hands and knees through the surf to avoid enemy fire.



This F4U from a Marine fighter group carries a terrific wallop in its eight rockets. The Marines were among the first of our forces to develop the technique of close coöperation between ground troops and supporting aircraft.

This young Marine symbolizes the character and nature of the Corps—alert, strong, efficient, canny, in where the fighting is the dirtiest—and always faithful.



Navy photos

The Marine command post, above, is directing the troops in the capture of Garapan, the main town on Saipan. The mobile rocket battery, left, is typical of the many modern ordnance weapons used by the Marines.

Month by Month

A Review of the National Defense Situation

Ordnance District News.—In keeping with the recommendations of the classic A.O.A. Bell Board Report (ORDNANCE, January-February 1947, p. 353), civilians are replacing Ordnance officers as chiefs of Ordnance districts. Four appointments have thus far been made: Detroit, Edward T. Gusheé; Rochester, Lyman K. Stuart; Springfield, John S. Begley; and St. Louis, Adrian W. Frazier.

Mr. Gusheé has an outstanding record in utilities. During the war years he helped to formulate Ordnance procurement policies. He is a director of the Michigan Post and a Council member of the Association.

Mr. Stuart is president of C. H. Stuart & Company, Newark, N. Y. During the war he served as president of the Price Adjustment Board in the Rochester area.

Mr. Begley is a former deputy chief and chief of the Springfield Ordnance District. He has also served as a representative of FDIC and RFC in the Springfield (Mass.) area.

Mr. Frazier is president of the Frazier-Davis Construction Company of St. Louis, one of the largest organizations of its kind in the St. Louis area.

There are now fourteen Ordnance Districts. On July 1st, the Los Angeles Regional Office was officially established as the Los Angeles Ordnance District. The new district comprises Utah and Arizona, 16 counties in California, and 4 counties in Nevada—a total of 322,874 square miles. This is well-deserved recognition of the importance of Los Angeles industry. As the Bell Board recommended, several other new Ordnance districts should be formed.

Munitions Board Chairman.—President Truman named Thomas J. Hargrave, president of Eastman Kodak Company, to be chairman of the Army-Navy Munitions Board, succeeding Richard R. Deupree.

Mr. Deupree, who served as chairman since February 1946, will continue to assist the Board in an advisory capacity.

Mr. Hargrave, a native of Wymore, Nebr., is a graduate of the University of Nebraska and Harvard Law School.

Captain of a machine-gun company in France during World War I, Mr. Hargrave was awarded the Distinguished Service Cross by General Pershing for extraordinary bravery in action.

Changed Face of War.—The United States—and the world—stand on the threshold of a new age in which guided missiles and transsonic and supersonic planes, with or without atomic bombs, will revolutionize the art of war as it was known two years ago.

The B-29 is destined to be supplanted by the B-50—a larger and more powerful bomber. The giant B-36, probably the heaviest and longest-range bomber in the world, is scheduled to come off the production line in the near future.

Slow progress is being made in the field of guided missiles. The United States has no long-range rockets equivalent to the V-2 or larger at the present time. Crewless airplanes and robot flying bombs of the German V-1 type are the only other kinds of long-range guided missiles that are available today.

The antiaircraft missile—rocket or ram-jet type—may revolutionize antiaircraft work if electronic beams or other devices can guide it accurately enough to its target.

No nation is ready for long-range missile war, for intercontinental air war, or for transpolar war. No nation has combat models of transsonic or supersonic planes, no nation has yet been able to send a piloted plane above 63,000 feet, and no nation has a plane with combat range sufficient for 2-way bombing raids across the oceans or across the polar ice cap.

But we are as yet in the early stages of the race for missile and air supremacy.

Atomic Bomb Casualty Commission.—The Commission's report, released by the War Department, indicates that sterility definitely belongs among the injurious effects to which the survivor of an atomic blast is vulnerable.

For some unexplained reason, the death rate for males at Hiroshima and Nagasaki was slightly higher than that for females.

Concrete affords such a degree of protection that a person within a concrete building 500 meters (slightly under one-third of a mile) from the ground center of the explosion fared no worse, on the average, than a person standing in the open 1,400 meters distant from the blast.

Prof. Masao Tsuzuki of the Tokyo Imperial University pointed out that the death and disability produced by the atom bomb results from its thermal energy, its mechanical energy, and its radioactive energy. They always act in combined form, giving medicine a new set of symptoms which he chooses to call "atomic-bomb injury."

Women who were in an early stage of pregnancy when exposed to the bomb blast have taken a normal course since the bombing.

Stock Piles Urged for Defense.—Fears that national-defense stock piles are being permitted to drop to dangerously low levels have been expressed by industrial executives. They urge a vigorous policy of stock-piling by the Federal Government during the remainder of the year.

Criticisms, intended to be helpful to the Government, fell into five major categories: (1) Failure to pass legislation which would create immediate authorization of machine-tool transfers from the WAA to the armed services reserve stocks; (2) Failure to recognize the importance and necessity of stock-piling brass ingot from scrap, now becoming less available with prices trending upward; (3) Failure to declare many machine tools as surplus and to permit tagging for the military reserve; (4) Failure to develop any over-all program of using equipment transferred to educational institutions for training mechanical and engineering students; and (5) Failure to adopt legislation guaranteeing adequate development of

pilot plant or "prototype" plant operations in key new industries vital to future industrial production of war material.

Immediate action by the Government to create an adequate copper stock pile for national-defense purposes was urged by spokesmen for the industries on which production requirements would be placed in any future emergency.

They said present stock piles are dangerously low or virtually nonexistent, and that steps should be taken promptly to create stock piles, first, by purchasing surplus brass in the open market, and secondly, by stock-piling the copper produced by marginal producers under any new premium price plan adopted by Congress.

Vice Adm. Edward L. Cochrane, chief of the Materials Division of the Office of the Assistant Secretary of the Navy, recently asserted that stock-piling of machinery and plant equipment and the preservation of key war production plants were equally as important as the stock-piling of strategic materials.

Mobilization Plan.—Hundreds of industrial and public organizations are lining up behind the War Department mobilization program to provide a reserve pool of trained man power for immediate use as service units in the event of another war.

Army sources reported tremendous early success for the program, which calls for the formation of 2,500 emergency Reserve Corps units in industries, hospitals, and municipalities.

Railroads, trucking companies, chemimal concerns, and aircraft and automotive industries are being drawn into the program, and the Army said it was going ahead as quickly as possible with plans for organizing them.

In case of war, the Army could call on coöperating organizations for men who could be put into the field as functioning units without long training.

Moral Offensive Advocated.—The Commission on a Just and Durable Peace of the Federal Council of the Churches of Christ in America, headed by John Foster Dulles, adviser to Secretary of State Marshall, expressed the view that "the free society versus the police state is the supreme political issue of our time" and called upon the American people to demonstrate that they stand for a basic moral and political principle and not merely for self-interest.

"If American initiative is to prevail," the Commission declared, "it must carry world-wide conviction on two basic facts: first, that our Nation utterly renounces for itself the use internationally of the method of intolerance; and, secondly, that persistence internationally by the Soviet Government or the Soviet Communist party in methods of intolerance, such as purge, coercion, deceitful infiltration, and false propaganda shielded by secrecy, will not in fact make its faith prevail and will jeopardize the peace."

The Commission urged the United States to make greater use of the United Nations as a means for promoting consolidation of moral force, "which is indispensable to peace."

Army Task Force Furnace.—The Army is conducting torrid-weather tests on basic equipment in the Arizona Desert as its latest contribution to global preparedness. Thirty officers and 270 enlisted men are enduring a purgatorial existence at Castle Dome Plain, an expanse just northeast of Yuma which is dotted with cactus, horned toads, and rattlesnakes.

The temperature hovers around 120 degrees, and choking dust is constantly churned up by a hot, steady wind that periodically blows up into small tornadoes.

Tanks, churning up brown clouds, roar around and around the test range. All types of weapons are fired, cleaned, inspected, fired again, and their performance carefully recorded. Other equipment, from uniforms to ice-cream machines, is constantly worked and checked.

In a few seconds dust filters into every mechanical cranny, as harmful as emery powder. Tanks must nightly be hosed down inside and out with compressed air and their oil and water filters changed. It takes two hours of maintenance daily to keep a camera in working condition.

World Police Force.—The United States delegation to the United Nations Military Staff Committee wants an international police force with the striking power of 1,250 bombers and 2,250 fighters and fighter-bombers, plus 300 reconnaissance planes.

Although the United States "preliminary estimate" of the force to be supplied to the Security Council included also 6 carriers, 3 battleships, and 90 submarines, members of the Security Council concentrated their attention on the recommendation of 3,800 airplanes, more than three times the number recommended by Great Britain, France, or China.

The United States proposals did not include planes required for air transport, which played a rôle of ever-increasing importance during the war. They did not specify whether the aircraft based on the six carriers were included in the 3,800 recommended.

In contrast, the French delegation specified a total international air force of only 1,275 planes. The British delegation, in an estimate concurred in by the Chinese, placed the number at 1,200.

Beneficial Uses of Atomic Energy.—Chairman David E. Lilienthal of the United States Atomic Energy Commission announced that the Commission is about to establish a bureau of medical research to study the beneficial uses of atomic energy.

The board of independent medical men who made the survey for this peacetime project were reported as saying that the benefits man will derive from the application of atomic power to life, comfort, and health will, in the long run, outstrip its military significance. It appears, however, that for the present the program will be mainly to protect the public against the effects of radioactivity.

"The need for medical and biological research on the various effects of radioactive substances and atomic fission is both urgent and extensive," says the report. "It is urgent because of the extraordinary danger of exposing living creatures to radioactivity . . . and because effective defense measures (in the military sense) are not yet known."

Senator McMahon, former chairman of the Senate Committee on Atomic Energy, declared that experimentation and research for peacetime atomic uses will go on. But he added that "unfortunately we have to put the main emphasis on the production of weapons."

Quest for Peace
Today's Challenge

¶ General Eisenhower says: "While some of our Allies were compelled to throw up a wall of flesh and blood as their chief defense against the aggressor's onslaught, *we were able to use machines and technology to save lives.*"

¶ Secretary of State Marshall, in his farewell report as Chief of Staff, established a yardstick of the Army's ability thus "to save lives" in stating: "As staggering as our casualties have been, the enemy forces opposing us suffered many times more heavily; 1,592,600 Germans, Italians, and Japanese troops were killed for the 201,367 American soldiers who died." Adding Navy losses to the Army's, we have, as of April 9, 1947, the melancholy total of 313,000 fine young Americans "killed in action." What a catastrophe!

¶ Our battle death toll was but twenty per cent of the enemy's because our "vastly superior industrial establishment" made it possible simultaneously to mount successful operations all over the world—with in every decisive case a strategic inferiority in numbers of troops more than offset by *logistical superiority in mobility and firepower*. Otherwise, our own combat deaths might well have approximated the enemy's frightful total of 1,592,600. Obvious logistical superiority in mobility and firepower enabled Patton's immortal Third Army to capture and disarm 1,280,688 Germans—or 5 times its own average total strength of 261,588. It wasn't essential to kill; it was only necessary to be ready, willing, and able to do so. The Krauts weren't so dumb—they got the point.

¶ Secretary of War Patterson tells us, "* * * we won the *gas* war without firing a gas shell or dropping a gas bomb. That our opponents did not challenge us on this scorce was due to our high state of preparedness. We were ready to retaliate in heaping quantity . . . if G(for gas)-day had materialized. Just as preparedness saved us from the ravages of gas warfare, so did our readiness for biological warfare deter the (Japanese) enemy from unleashing bacteria, fungi, rickettsiae, and toxic living agents to produce diseases in persons, animals, and plants. . . . The enemy so respected our *retaliatory potential* that we were spared the horrors of this type of warfare." The Japs weren't so dumb either—they also got the point. The Secretary goes further and bluntly states, "* * * it is a moral certainty that there would have been no World War II. Hitler and the Japanese warlords would never have dared to launch their drive for world rule if the United States had had readily available military strength."

¶ So, our eventual logistical superiority in mobility and firepower saved 80 per cent of our battle-death expectancy—but it took us forty-four months to do it. If we had achieved an unquestioned logistical superiority in December 1941, we would have saved the remaining twenty per cent of battle deaths—313,000 brave young Americans. And, according to our Secretary of War, if we had accomplished it in September 1939, there is ground for belief that we might have averted World War II altogether and saved the world some 20,000,000 human lives.

¶ In our past efforts to prevent war we have tried disarmament. We have tried treaties and international agreements. We have tried isolation. We have tried neutrality. We have tried moral suasion. We have tried threatening notes. We have tried stalling. We have tried appeasement and pacifism. *None of them worked*. The only method we have never tried is to adopt and carry out a sound and well-balanced program of preparedness.

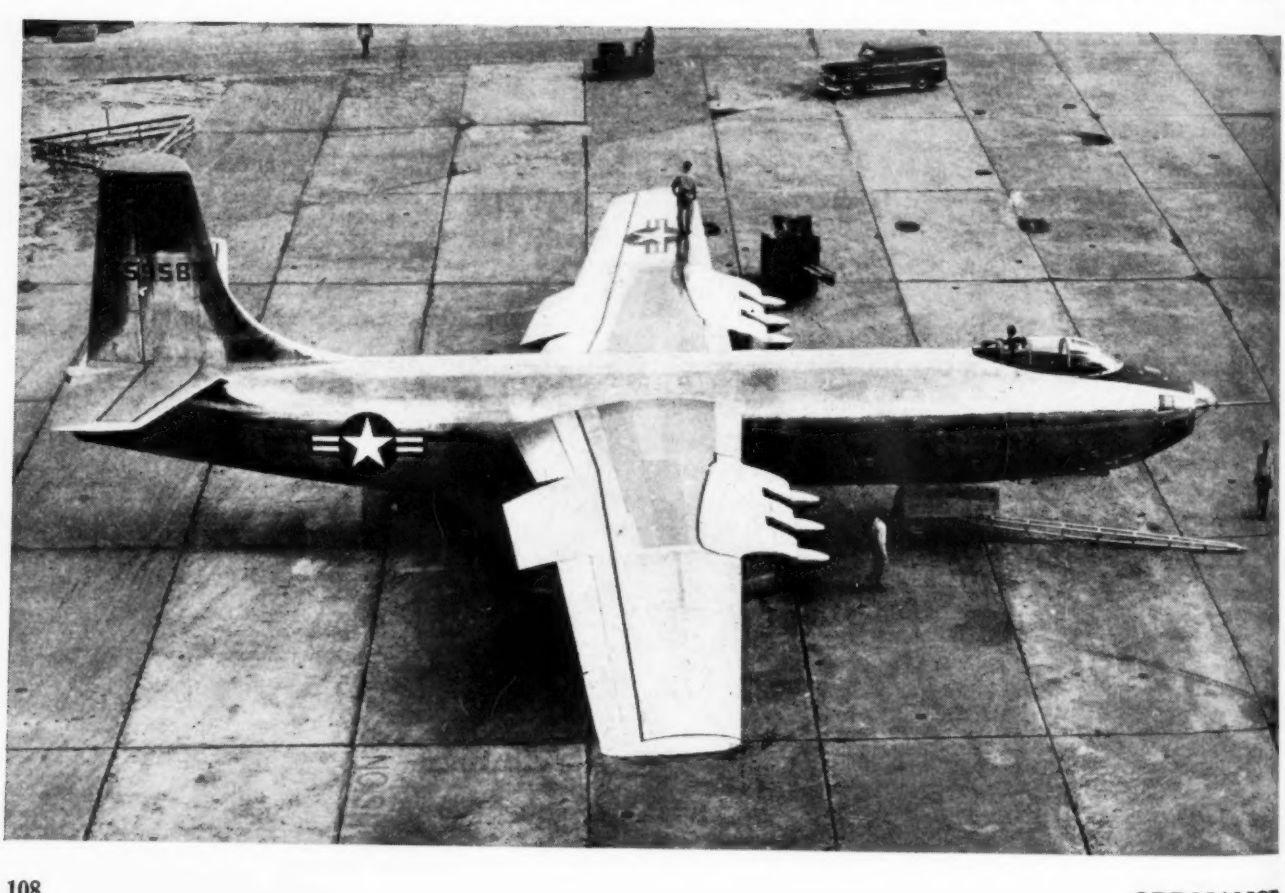
¶ During World War II, American scientists, engineers, and industrialists provided "the machines and technology to save lives." They shortened the war and reduced battle-death expectancy by eighty per cent. Their continued interest in scientific and industrial preparedness may well avert war altogether—and reduce our battle-death expectancy to zero. That is today's challenge!

James L Walsh

President, Army Ordnance Association.

New Experimental Aircraft

The Navy's XHRP-1 tandem helicopter, above, shows its lifting ability by successfully transporting a jeep. Powered with a 600-horsepower engine it will cruise at 100 m.p.h. with a one-ton load. The AAF photo below shows the Army's latest jet bomber, the Martin XB-48. Its radical tandem landing gear retracts into the fuselage permitting a thin, high-speed type wing.



Association Affairs

INDUSTRY-AIR-ORDNANCE: Michigan Post Stages Spectacular Show

The Michigan Post, Army Ordnance Association, observed the beginning of its seventh year with an historic meeting at Selfridge Field on the afternoon and evening of June 19, 1947. Special thanks are due to Maj. Gen. B. W. Chidlaw, deputy chief of staff for engineering, Air Matériel Command, Wright Field, Ohio; to Col. William P. Hudnell, wing commander, 56th Fighter Group, Selfridge Field; and to Col. Philip Schwartz, Ordnance Officer, Strategic Air Force, Andrews Field, Washington, D. C.

These officers and their capable assistants arranged and directed a program of unusual scientific and technical significance. It was a gala day for the Ordnance stalwarts of Michigan and contributed greatly to their understanding of Industry-Air Force-Ordnance teamwork.

The committee in charge started with the intention of assembling a crowd of 600 to 700 people. As plans progressed there were indications that more would attend. A 10:30 A. M. on the day of the meeting, returns were in hand indicating that 1,566 members and guests would be present and that 1,264 wished to stay for the picnic supper held on the Selfridge Field officers' picnic ground on the lake shore.

Members and guests had been invited for 3:00 P. M. The morning papers foretold rain, but the day turned out to be beautiful and sunny with even the wind in the right direction to keep mosquitoes off the picnic ground and to provide the planes with the most expeditious runway. Therefore it soon became apparent that a good many more people were going to come than had previously indicated their intention.

By 2:00 P. M. there was a steady line of traffic. Admission to the field was gained by presentation of the Army Ordnance Association invitation. As a result, over 1,500 cars were admitted with an estimated 5,400 people! In addition, over 300 persons were turned away who apparently were not members of the Army Ordnance Association or guests accompanying a member.

The static displays on the grounds consisted of the following:

1. A display of different types of aircraft including the B-29 with power turrets operating; the B-17; the Fairchild Packet or Flying Boxcar with a helicopter unloaded from it; Betty Jo, the twin-engined Mustang fighter that flew nonstop from Honolulu to New York; the P-51 Mustang; and the jet-propelled P-80 Shooting Star.
2. A special Air Force vehicle display consisting of approximately fifteen vehicles.
3. An Air-Sea rescue unit displaying life rafts, a lifeboat to be dropped later from a B-17, and all the equipment that went with it; a helicopter and its rescue equipment.
4. A bomb and armament display.
5. A complete hangar in which was shown a comparison of the simplicity of the P-80 jet fighter and the P-51 Mustang, with accompanying jet jobs in various states of disassembly to display the engines.
6. A GCA unit (ground control approach system for landing aircraft under adverse weather conditions).
7. A P-80 on the hangar apron whose engine was intermittently started and stopped.

The aërial activity during the day consisted of the following:

1. A flight of twenty or thirty attack bombers operated by Reserve pilots.
2. Miscellaneous flights and demonstrations of P-80 jet planes and P-51 Mustangs.
3. The laying of a smoke screen by a P-51.
4. Ground strafing with caliber .50 blanks by four Mustangs.
5. Dropping of fragmentation bombs by four Mustangs.
6. Simulated attack on Selfridge Field by a squadron of twelve jet fighters from their Gunnery Base at Oscoda, Mich. The crowd was advised over the public-address system when the formation left Oscoda and was kept advised of their progress until they struck the field 12½ minutes later (about 125 miles).
7. A flight of four P-80's left Chicago and the crowd was appraised of their progress over the loud speaker until they arrived thirty-two minutes later. (A flight of three P-80's from New York was canceled because of bad weather.)
8. Two P-51 Mustangs raced across the field at low altitude and were overtaken and passed by a P-80 Shooting Star, showing comparative speeds. Following this, most of the crowd went home, but about 1,500 went to the picnic grounds where sandwiches and other refreshments were served and where General Chidlaw gave an address on the engineering problems of the Air Matériel Command.
9. After the speech, the Air-Sea rescue B-17 dropped its lifeboat which was boarded by four men from a raft and sailed ashore.

The finale was a low-altitude parade by Betty-Jo, the B-29, the B-17, the Fairchild Packet, and even one flight by the B-29 with both port engines stopped and propellers feathered. It was rather spectacular to see this and then watch one engine after another start up.

The grand finale was a terrifically fast streak of a P-80 which roared down from 20,000 feet. The crowd called him back for three encores. It certainly was spectacular to see this plane worm up into the sky in a perfect slow roll and then disappear through a bright spot in a couple of fleecy clouds.

Altogether it was a fascinating performance made more memorable by the quality of the aircraft, the ordnance equipment, and the skill of the personnel.—Robert L. Biggers.

LOS ANGELES POST: New Officers and Directors

The Los Angeles Post, Army Ordnance Association, continues to go great guns. On June 3, 1947, a meeting was held of the incoming and retiring boards of directors of the Post. The recent election of directors and officers was confirmed. H. C. Thomas relinquished his duties as president of the Post after a term during which the organization made substantial and impressive progress. The new officers have gone on record as determined to continue the policies inaugurated by Mr. Thomas and to enlarge and enrich the Post's program so that the Army Ordnance Association will continue to be the recognized leader among proponents of scientific and industrial preparedness in Southern California.

The newly elected officers and directors are: President: Walter C. Main, Technical Oil Tool Corporation, Ltd.; Vice-President: M. M. Mitchell, Pacific Telephone & Telegraph Company; Secretary: C. H. Nazro, Byron Jackson Company; Treasurer: Samuel K. Rindge, investment counsel.

The Board of Directors consists of the above officers and

Henry L. Clark, General Motors Corporation; R. O. Cragin; Trevor Gardner, General Tire & Rubber Company; K. T. Norris, Norris Stamping & Manufacturing Company; Maurice Pendleton, Plomb Tool Company; John B. Rauen, United States Spring & Bumper Company; John D. Spalding, National Supply Company; Reese H. Taylor, Union Oil Company of California; Philip F. Thayer, Rheem Manufacturing Company; H. C. Thomas, Alumalux Company; Carleton Tibbets, Los Angeles Steel Casting Company.

Now that the great industrial region of the Los Angeles area has been raised to the dignity of an Ordnance district in its own right (see page 105), the program of the Post and the scope of its usefulness has increased greatly. The new officers are determined that no opportunity will be lost to further scientific and industrial preparedness on every occasion.

MEN OF LOYALTY: They Served Their Country Well

On March 31, 1902, a young man inquired "whether the work at Watervliet Arsenal would be steady." On March 31, 1947, he retired after forty-five years of continuous service and after having risen to the top civilian ranks in the Watervliet organization. He is Wilmot H. Roblin, senior ordnance engineer and chief inspector of cannon at Watervliet. He holds the Meritorious Award for outstanding service in line of duty.

When Mr. Roblin was first employed at Watervliet he was one of 400 employees. During World War I that famous gun factory employed about 5,000. During the early 1930's employment slipped down to 125 men! During the second World War nearly 10,000 men and women were employed by Watervliet. Mr. Roblin was first president of the foremen's organization at the arsenal and is a former president of the Twenty-Year Club. He is an active and popular member of the Capital Cities Chapter of the Empire Post, Army Ordnance Association.

Michael D. Maloney, chief armament adviser, headquarters, Sixth Army, Presidio of San Francisco, Calif., has retired after thirty-nine years of service. Mr. Maloney entered the Ordnance Department at Benicia Arsenal, Calif., in 1908 as an armament machinist. He rendered continuous service since that date in both a civilian and military capacity. He was commissioned a captain in the Ordnance Reserve Corps in April 1918 and after World War I was reëmployed in his civilian status.

For many years he served at the Hawaiian Ordnance Depot as resident machinist and armament foreman. He became an employee of the Ninth Service Command during World War II when the service commands took over all technical service employees of the old corps areas. He will be remembered by many members of the Ordnance fraternity who served in Hawaii during the last twenty-five years.

A.O.A. SCHOLARSHIP AWARD: Presented to R.O.T.C. Ordnance Students

The Army Ordnance Association's Scholarship Awards have recently been presented. At the end of the scholastic year in universities and colleges having R.O.T.C. ordnance instruction, A.O.A. medals are awarded to those cadets who are outstanding, not only in ordnance, but also as students and Americans. These men will be able to assume their proper positions in the Ordnance fraternity to help in creating a strong America for a lasting peace. The institutions presenting the awards and the recipients are:

Georgia School of Technology: Cadet 1st Lieut. Raleigh S. Cox of Killen, Ala. Lieutenant Cox is a veteran of World War II, having served in France and Germany with the 100th Infantry Division. He is a member of the first year advanced class and is majoring in mechanical engineering and, in being considered for the award, he "measured up to all possible standards."

University of Michigan: Cadet Robert E. Rugar of Perry, Ohio. Prior to returning to the university, Mr. Rugar served in an Army Ordnance depot for 33½ months as a specialist. In receiving the award, he was cited as having "distinguished himself in leadership and scholarly attainment in the Ordnance section. . . . His ability reflects great credit upon himself, the University of Michigan, and the Reserve Officers' Training Corps."

Agricultural and Mechanical College of Texas: Cadet Capt. Jack L. Slack of Taylor, Tex. Captain Slack, majoring in mechanical engineering, was selected for the award as being the outstanding cadet in the Ordnance unit of his college. He is the commanding officer of Company A, Ordnance, at the college.

University of Cincinnati: Cadet 2nd Lieut. Frederick W. Sudhoff, a senior, and Cadet Capt. Richard A. Lodwick of the first year advanced course. Lieutenant Sudhoff, the first postwar R.O.T.C. graduate and an honor student at the university, is a veteran, having served with the Engineers overseas. He was commended by his R.O.T.C. commanding officer as being outstanding in the R.O.T.C. Captain Lodwick, a former Army Infantry first sergeant, is also an honor student and was regarded by his R.O.T.C. commanding officer as clearly meriting this award.

Cornell University: Cadets Joseph L. McGinnis of Tannersville, N. Y., and Philip R. Pullen of Lead, S. Dak. Mr. McGinnis, a veteran of four years in the Army, is a member of the Ordnance Advanced R.O.T.C. Unit and has outstanding military and academic averages in major subjects. Mr. Pullen, a veteran Ordnance specialist, has an enviable record in the R.O.T.C. Unit and has proved his ability by meriting the Army Ordnance Award.

University of Oklahoma: Cadet Lieut. Col. Herbert D. West, Jr., of Columbus, Miss., and Cadet Maj. James O. Melton of Hastings, Okla. As the outstanding Ordnance senior, Colonel West was presented the Association's award by Maj. Gen. Clift Andrus, having distinguished himself as a student and a leader. Major Melton, the outstanding Ordnance junior, was also presented the Association's award by General Andrus. A veteran of Ordnance during the war, he merited his award by his superior record in academic and military courses.

Louisiana State University: Cadet Capt. Hal D. White and Cadet Lieut. Leeland H. Jones. Captain White was awarded the medal for his outstanding achievement in the second year advanced Ordnance course, reflecting great credit upon himself and the university. Lieutenant Jones, through his clearly demonstrated ability as a student and a cadet officer, was awarded the medal for achievement in the first year advanced Ordnance course.

SHOW YOUR COLORS: Wear the Insignia of the A.O.A.

With the Twenty-ninth Annual Meeting of the Association less than a month away (see announcement on p. 100), all A.O.A. members who plan to attend the sessions at the Waldorf-Astoria and at Aberdeen Proving Ground will want to show their affiliation with their society by wearing its colors on uniform or civilian dress.

A list of the various types of insignia for military or business wear is printed on page 136 together with an order form for your convenience. Use it today.

NECROLOGY

NOTICE has been received of the deaths of the following members of the Association: K. G. Berggren, West Orange, N. J.; D. G. Gardner, Cincinnati, Ohio; J. B. Goss, Waterbury, Conn.; D. J. Hutchinson, Detroit, Mich.; W. G. Jenkin, St. Louis, Mo.; C. J. McClelland, Houston, Tex.; P. J. McLaren, New York, N. Y.; R. Medland, Chicago, Ill.; R. F. Morley, Rochester, N. Y.; L. F. Quigg, Pueblo, Colo.; R. J. Sever, Indianapolis, Ind.; A. H. Tuechter, Cincinnati, Ohio; and T. L. Wilder, Detroit, Mich. To their relatives and friends, ORDNANCE, on behalf of the Association membership, extends condolences.

Professional Digest

ATOMIC ENERGY FOR THE NAVY

Development of atomic power for naval ship propulsion has been made the mission of three new sections established in the Bureau of Ships, the Navy Department has announced.

The electronics design branch of the Bureau has also been linked to the new organization for study of nuclear power which will seek new techniques and will continue the search for lessons from last year's historic Operation Crossroads. The atomic power group will consist of the atomic warfare defense section, the radiological safety section, and the nuclear power section.

Atomic power and weapons development at the highest level in the Navy is under the direction of Rear Adm. William S. Parsons who holds the title of Director of Atomic Defense, in addition to being Deputy Chief of the Armed Forces Special Weapons Project in the Office of the Chief of Naval Operations. He also was a Deputy Commander of the Joint Army-Navy Task Force No. 1, which carried out the Crossroads atomic bomb test at Bikini.

The atomic warfare defense section was made responsible for the scientific investigation and development of measures to protect ships against atomic weapons. It will seek to introduce features of ship design for the collective protection of personnel from blast, pressure, heat, and radiation of atomic weapons. Lessons from the atomic explosion at Bikini will be applied where possible.

The problem of nuclear power for ship propulsion was assigned to the nuclear power section. It will also cope with the difficulties of shielding the personnel who might operate nuclear power plants from the effects of radiation poisoning. The latter rôle will be undertaken in coöperation with the radiological safety section whose job is to devise the protection of individuals from atomic explosions and radiological ship contamination.

Rôles relating to the atomic power program were also assigned to the electronics design branch, the special applications section, and the electronics equipment section.

The electronics design branch was assigned the task of developing protection of the delicate electronic equipment used in the control and firing of weapons, one of the great advances of the recent war. Such weapons could easily be rendered useless by knocking out the instruments.

The special applications section will develop instruments for detection of radioactivity and of fissionable material, the explosive of the atomic bomb. It is planned to coördinate this work with War Department agencies through the Joint Research and Development Board. The electronics equipment section assumes responsibility for procuring radiological instruments authorized by the radiological safety section.

ATOMIC POWER FOR BRITAIN

The British Admiralty also has hinted that it may try to develop an atom-propelled battleship. In a statement saying it planned research to maintain the navy's efficiency, it declared:

"Many lines of inquiry present themselves. On the defensive side, the navy has to apply the lessons learned by its observers of the Bikini tests of the atomic bomb, but the implications of atomic energy are by no means limited to defensive aspects and may, contrary to initial reactions, lead to enhancement of naval power in a highly modified form and with wide offensive and defensive commitments.

"The atomically propelled battleship, for instance, would have no immediate refueling problems, and the period for which it could stay at sea would be limited only by other and generally less urgent supply problems, a vital factor if the ship proved less vulnerable than the harbor."

The statement said $24,000,000 would be spent in all forms of navy research this year. The Ministry of Supply announced that a school to train youths past 14 for atom work would be opened at what it called "the Government atomic energy factory" at Springfields in northern England. The plant, previously known as a research center, "will be used for the manufacture of uranium metal," the announcement said.

Students will be paid while studying and will get jobs in the factory after completing chemistry courses.

"Both in the factory operations and in chemical analytical work the most stringent medical precautions will be taken to avoid any hazard to the health of the workers," the ministry said.

NEW SUBMARINES PLANNED

The Navy laid before Congress recently a 4-year plan for the development and exploitation of new types of submarines and surface craft of far-reaching importance.

Concentrating on the potentialities of troop-carrying and cargo-carrying submarines and the development of antisubmarine measures to counter the best in submarine practice, the plan looks particularly to the special needs required by operations in polar waters.

The new program is one of ship conversion so extensive as to amount almost to new construction. It draws importance from the fact that much of it is based on submarine work completed by the Germans just before the end of the war, which was well in advance of anything on the allied side.

The antisubmarine developments included in this plan will enable the Navy to work up an antisubmarine technique capable of competing with the latest in submarine development. The secrets obtained from Germany were shared with the British and the Russians, the latter having the additional advantage that they occupied the German submarine-building bases and captured many of their builders and designers.

Authorization has been sought to build two troop-carrying submarines, one cargo-carrying submarine, two landing ships (dock), one picket submarine for special Arctic patrol and reconnaissance work, and a general-cargo transport reënforced for work in ice-infested waters, as well as nine destroyers especially equipped for antisubmarine work.

The troop-carrying submarines are expected to be able to carry one hundred men fully armed in addition to a crew of about sixty.

Later, on July 13th, the Navy disclosed that two new experimental submarines—the world's fastest undersea combat craft—would be completed in 1951 and would be radically different from those that sank two-thirds of Japan's merchant fleet in World War II.

Congress appropriated $33,000,000 for the vessels and incidental experimental work. They will incorporate secrets known only to the United States Navy, plus secrets captured from the Germans and the Japanese in the war.

They will be named after the wartime submersibles TANG and TRIGGER.

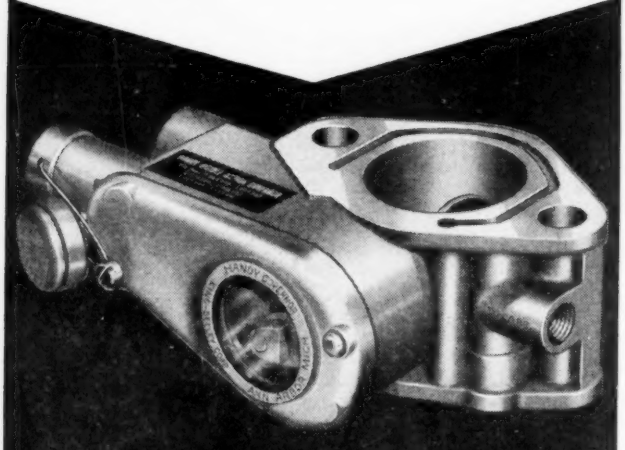
Hull, machinery, and contract plans are being prepared by the Bureau of Ships and the Portsmouth (N. H.) Naval Shipyard. The TANG will be built in Portsmouth and the TRIGGER in a private yard.

While the Navy is giving no details, it is known that the Germans were working on a submarine at the close of the war which could stay under water for long periods and travel below the surface at 25 to 26 knots. The conventional American submarines can make only about 11 or 12 knots under the surface.

Both ships will carry new-type weapons and more efficient sonar equipment for detecting the enemy.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

the governor that
assures economy
of automotive
vehicle operation



The Handy Vari-Speed Governor used on many well-managed truck fleets over a period of years has proved its outstanding value in preventing costly operating practices.

A poll of 180 such fleets shows actual savings as follows:

General maintenance	26%
Engine repair	32%
Tire maintenance	22.6%
Insurance	16%
Lubrication	26%
Fuel	13.5%
Brake maintenance	29.2%
Accidents	37%

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Guided Missiles

WEATHER FORECAST FOR V-2 FIRINGS

A small but efficient weather station has been installed at the White Sands Proving Ground, N. Mex., by the Air Weather Service of the Army Air Forces. Technicians at White Sands are primarily interested in meteorological conditions of the upper air regions rather than weather close to the earth's surface which affects normal air traffic.

Four complete forecasts ranging from seventy-two to four hours before each V-2 firing are required to ensure the success of the program. The forecasts have the following purposes: The 72-hour forecast is for the necessary planning and setup of the supplies for the day of the firing. A 48-hour forecast determines whether it is advisable to take the assembled rocket down to the launching site or to leave it in the assembly hangar. A 24-hour forecast determines the rate of installation of the instrumentation and whether to continue with the scheduled program. The final forecast determines the practicability of fueling the rocket for the firing.

The forecasts are essential due to the expense incurred by delay, the decreasing chance of a good firing by excessive movement of the rocket, and the loss of time and money which results if the rocket is not launched shortly after it is completely fueled. Due to the nature of its composition, a major delay necessitates the dumping of the fuel. Similarly, any delay resulting from weather causes a loss in maximum velocity due to oxygen loss on the ground.

Besides the regular forecasting, the AAF weather station is also responsible for measuring winds at high altitudes. Winds materially affect the course of a V-2 even at the tremendous speeds it attains. With the data provided by the AAF weather station, White Sands officials can determine the necessary degree of safety precautions to be taken in the event a V-2 gets out of control during the early portions of its flight.

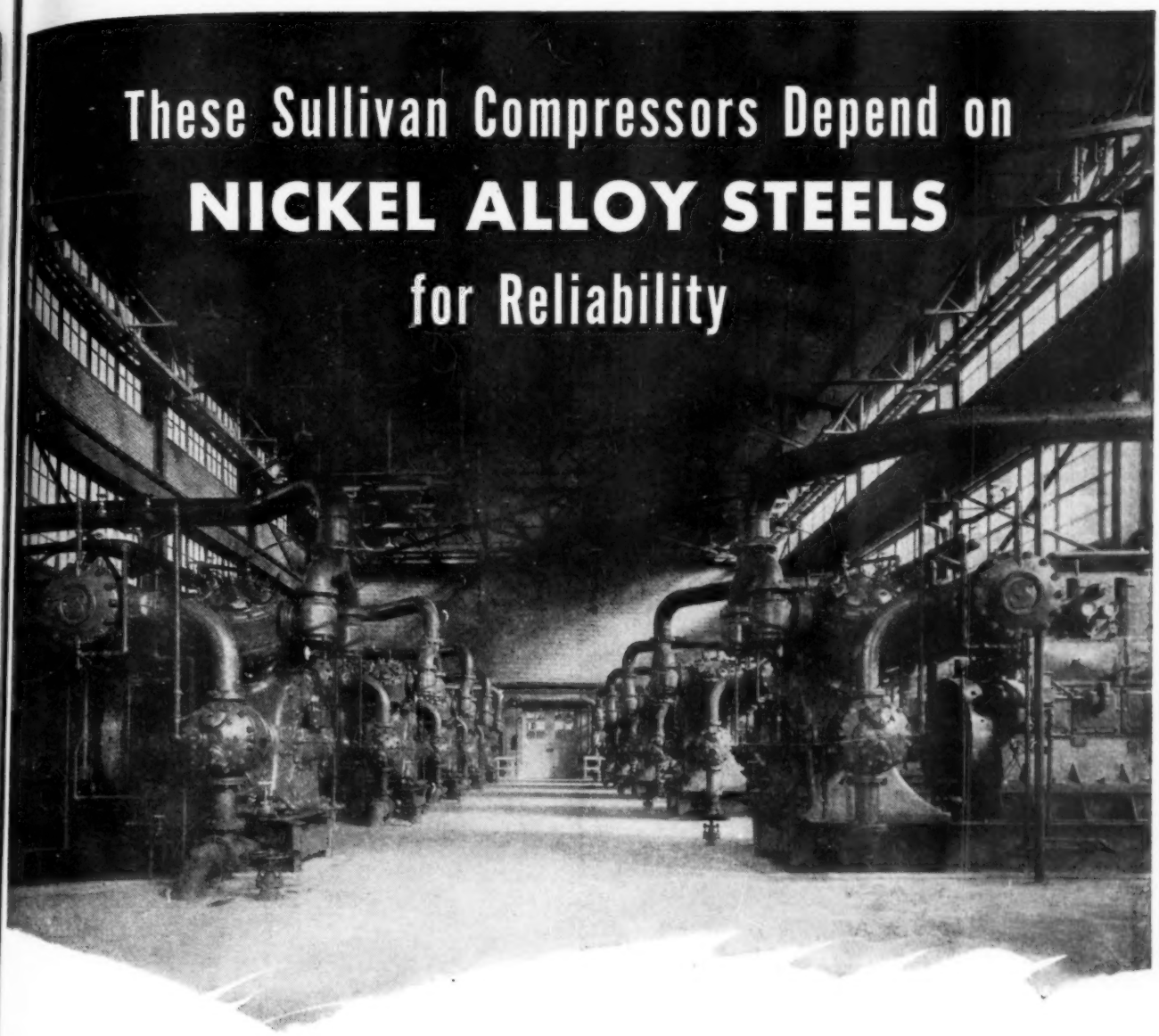
INSTRUMENTS AT WHITE SANDS

The Army Corps of Engineers will install instrumentation capable of showing the speed, trajectory, range, and other characteristics of guided missiles for approximately the full 90-mile length of the White Sands Proving Ground. This instrumentation system, which has been started with funds provided by the Navy, will be coördinated with existing and proposed Army installations in order properly to orient and integrate all communication and instrumentation facilities at the proving ground. Approximately seventy-five additional instrumentation stations will be erected.

ROCKET TO RIDE ON BEARINGS

Superrockets which can travel farther, faster, and more accurately than anything yet developed may be the result of a new projectile design which uses a ball bearing and a needle bearing to generate a swirling flow of gases.

The design introduces a rotating sleeve with a series of jets at the rear end of the missile. Instead of the propellent gases expanding directly into the air, they are first detonated in a small chamber. From there they push through slanted jet openings in the rotary discharge mechanism, spinning it somewhat like a pin wheel as they go. The invention promises to eliminate yaw created by dampness or uneven explosion of the propellent gases.



These compressors, built by the Sullivan Division of Joy Manufacturing Company, are a good example of the way Nickel alloy steels help make equipment longer-lasting and more dependable.

Crankshafts in these units are of large diameter, and accordingly, a Nickel-chromium-molybdenum steel, Type 4340, is used to secure good depth hardening. This steel makes possible heat treated forgings that provide ample strength, good ductility and ready machinability.

Cross head pins and other stressed parts are produced in a case hardening Nickel-molybdenum steel, Type 4615. This steel responds readily with minimum distortion to simple quenching treatments, and affords a wear resistant, non-spalling surface supported by a tough core that enables the part to resist shocks and overloads.

The excellent mechanical and fabricating properties of Nickel alloy steels provide a practical answer to problems of low-cost, trouble-free operation of equipment.

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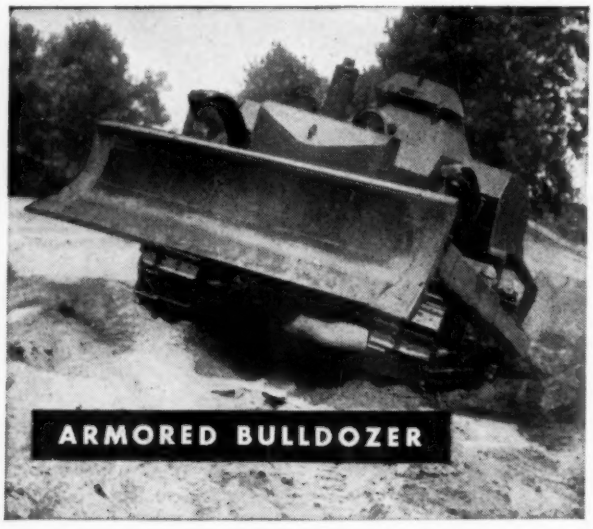

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Ordnance Glossary

Some Explanatory Notes on the Ordnance Department and Ordnance Matériel—Part V

F. W. Foster Gleason

THIS compendium of ordnance terms has been compiled as an aid to the readers of ORDNANCE and to all students of armament in interpreting the terminology of the literature.—THE EDITORS.

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procurement objective: The amount required or declared required during a calendar year.

projectile: Any missile projected by force; specifically one propelled by an explosive.

propellant: The propelling charge—usually gunpowder—used to drive forward a rocket or other projectile. (Propellent, *adj.*)

RDX: A high explosive of relatively great sensitivity and high brisance; widely used (generally in composition with other explosives) as a bursting charge in rockets, bombs, and some small shells.

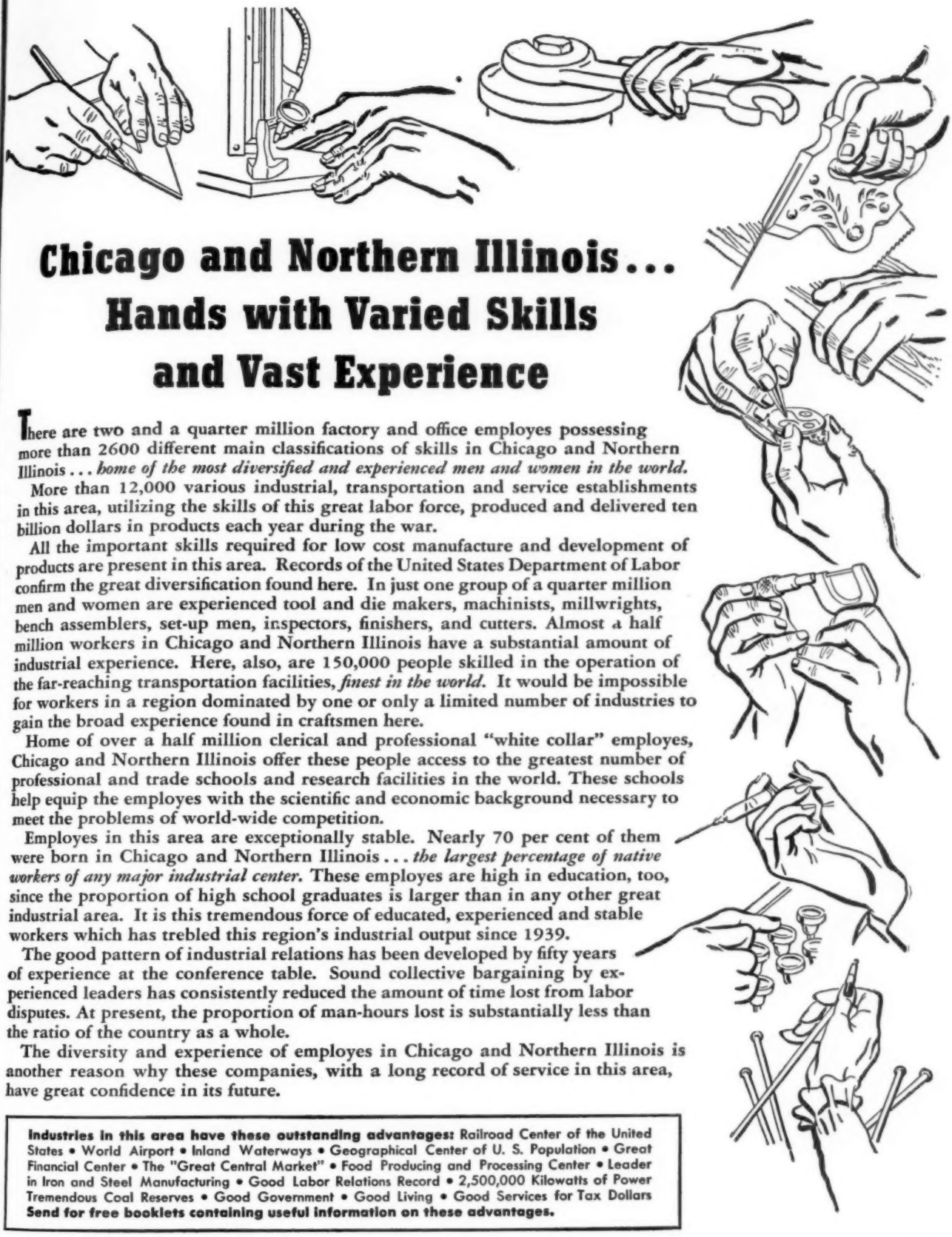
recoilless rifle: A gun of a design that permits its discharge with no rearward movement of gun barrel or mount. A development of World War II, its overcharge of propellant—burning in a perforated cartridge case—projects a heavy blast of gas rearward through a "grille-type" breech, entirely neutralizing recoil. The 57-mm. size (which reached both European and Pacific fronts in limited quantities in time to render signal service) weighs just over forty pounds and is fired from the shoulder. The 75-mm. gun weighs 110 pounds and is fired from a light machine gun tripod. Both fire shaped-charge shell with great accuracy to long ranges.

recoil mechanism: Device designed to absorb the shock of recoil of a gun and to return it to battery (see counter-recoil).

recuperator: That part of a recoil mechanism which returns the gun to battery after recoil.

ring mount: A machine-gun mount in the form of a circular track on which the gun slides, permitting all-around fire. Usually mounted on the top of tanks, trucks, small craft, and the like, it generally provides their principal antiaircraft protection.

rocket: A projectile propelled by the reaction of gases escaping from a jet or nozzle at the rear of its combustion chamber. Probably more ancient than artillery itself, it is only the phenomenal development of this weapon in World War II and after that has made it a formidable rival of the gun. Some of the principal U. S. rockets were: (1) The bazooka projectile (which see); (2) The 4.5-inch fin-stabilized rocket ranged to 4,600 yards, but inherent dispersion limited aimed fire to much shorter ranges; it was fired from single and multiple launchers mounted on the ground and on tanks, trucks, jeeps, landing craft, and planes; (3) The 4.5-inch spin-stabilized rocket weighs 42.5 pounds, carries a bursting charge of 5.3 pounds of TNT, and ranges 5,300 yards with considerably improved accuracy; it may be fired from several types of launcher but principally from the mobile high-speed, towed launcher whose 24 tubes (fired singly or "ripple" as desired) provide barrage fire against area targets; (4) The 7.2-inch rocket is a 61-pound projectile with a 32-pound charge of TNT and a maximum range of 230 yards; designed for demolition work at close range, it is fired from a 20-tube launcher on the medium tank. *(Continued on p. 116.)*



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More than 12,000 various industrial, transportation and service establishments in this area, utilizing the skills of this great labor force, produced and delivered ten billion dollars in products each year during the war.

All the important skills required for low cost manufacture and development of products are present in this area. Records of the United States Department of Labor confirm the great diversification found here. In just one group of a quarter million men and women are experienced tool and die makers, machinists, millwrights, bench assemblers, set-up men, inspectors, finishers, and cutters. Almost a half million workers in Chicago and Northern Illinois have a substantial amount of industrial experience. Here, also, are 150,000 people skilled in the operation of the far-reaching transportation facilities, *finest in the world.* It would be impossible for workers in a region dominated by one or only a limited number of industries to gain the broad experience found in craftsmen here.

Home of over a half million clerical and professional "white collar" employes, Chicago and Northern Illinois offer these people access to the greatest number of professional and trade schools and research facilities in the world. These schools help equip the employes with the scientific and economic background necessary to meet the problems of world-wide competition.

Employes in this area are exceptionally stable. Nearly 70 per cent of them were born in Chicago and Northern Illinois... *the largest percentage of native workers of any major industrial center.* These employes are high in education, too, since the proportion of high school graduates is larger than in any other great industrial area. It is this tremendous force of educated, experienced and stable workers which has trebled this region's industrial output since 1939.

The good pattern of industrial relations has been developed by fifty years of experience at the conference table. Sound collective bargaining by experienced leaders has consistently reduced the amount of time lost from labor disputes. At present, the proportion of man-hours lost is substantially less than the ratio of the country as a whole.

The diversity and experience of employes in Chicago and Northern Illinois is another reason why these companies, with a long record of service in this area, have great confidence in its future.

Industries in this area have these outstanding advantages: Railroad Center of the United States • World Airport • Inland Waterways • Geographical Center of U. S. Population • Great Financial Center • The "Great Central Market" • Food Producing and Processing Center • Leader in Iron and Steel Manufacturing • Good Labor Relations Record • 2,500,000 Kilowatts of Power Tremendous Coal Reserves • Good Government • Good Living • Good Services for Tax Dollars
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Ordnance Glossary

rotating band: A ring of relatively soft metal pressed into a knurled groove near the base of a projectile for rifled artillery. The band's engagement with the rifling causes the projectile to spin upon its own axis when in flight.

round (complete round): All amunition components necessary to fire a weapon once. Round includes projectile, propellant, primer, and (except in separate-loading ammunition) case.

small arms (SA): Rifled firearms of caliber .60 or less, including rifles, pistols, carbines, machine guns, and shotguns regardless of caliber. (*Note:* This definition is accepted for general use, but it is at present in a state of flux. Ordnance Department usage now includes also bayonets, knives, steel helmets, recoilless rifles, body armor—in fact anything which is under jurisdiction of the Small Arms Service.)

semiautomatic rifle (SAR): A rifle which automatically reloads after firing but fires only one shot for each separate pressure on the trigger.

semifixed ammunition: A round in which the projectile, fitted loosely to the cartridge case, may be removed to permit varying of the propellent charge (for zone firing); generally used for light and medium howitzer ammunition.

separate-loading ammunition: A round in which the components (projectile, propellant, igniter, and primer) are not assembled before loading. In a special type of separate-loading ammunition (often called "separated ammunition") the propellant and primer are contained in a cartridge case which is loaded into the gun after the projectile is inserted (as for the 120-mm. antiaircraft gun.)

shaped charge (hollow-head charge): A charge of high explosive so molded that it forms a cone-shaped cavity directed at the point at which it is desired to concentrate the greatest force of the burst; used in modern armor-piercing projectiles and in some demolition charges.

shot: A solid projectile—containing no explosive—but often with tracer (which see) in base.

shrapnel: A type of shell, named for the British officer who invented it in 1784, obsolescent after World War I. It consists of a case or shell provided with a bursting charge and filled with balls. Current use of the term to describe shell fragments is as yet incorrect and may be confusing.

sleigh: That part of an artillery piece which supports the tube, recoiling and returning to battery therewith; it slides in grooves upon the cradle (a nonrecoiling part).

small arms (SM): The Ordnance Department is presently working on a definition of this, perhaps the most questioned term in ordnance nomenclature, which will be acceptable to the various divisions of the Department. Pending this decision, a combination of two current (though unsatisfactory) definitions must serve: (1) Firearms of less than caliber .80 (includes pistols, carbines, rifles, shotguns, machine guns); (2) All arms which may be, and commonly are, fired from the shoulder or a machine gun tripod.

spall: Pieces that crack, flake, or fly off as the result of failure of armor plate on either outer or inner face.

stabilizer: Device for maintaining the tube of a gun, mounted on a vehicle, in fixed relation to point of aim while the vehicle is in motion (overcoming roll and pitch).

standard dollar weight: Standard dollar value of an item, frozen in order to provide a basis of comparison between separate dollar-value tabulations which may be compiled on different dates, expressed in percentages.

standard nomenclature lists (SNL): Lists of parts and equipment for use in procurement, storage, and issue of matériel; a system of uniform nomenclature, which includes parts common to various items and lists parts and tools available to all echelons.

stockage, or stock, level: The objective level about which the actual stock on hand will fluctuate. *(Continued on p. 118.)*

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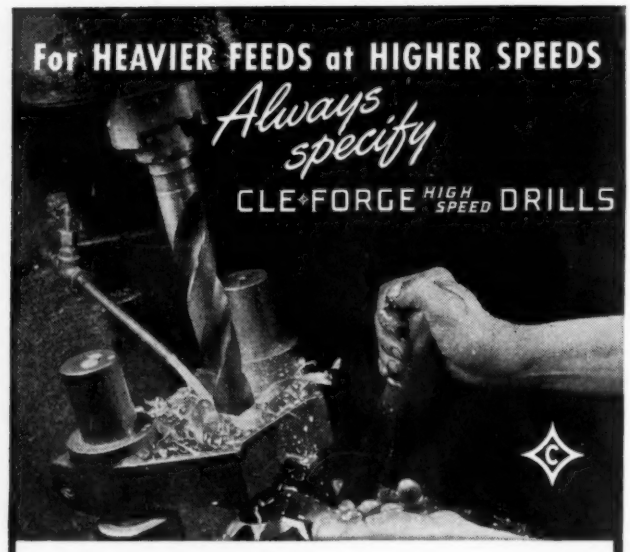

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Ordnance Glossary

strategic material: Material which is essential to the prosecution of a war.

submachine gun (SMG): A short, light, full-automatic weapon of small-arms caliber designed to be fired from shoulder or hip—usually with detachable or extendable stock. The Thompson SMG (Tommy gun) is about 34 inches long, weighs about 12 pounds, and has detachable wood stock; during the war it was replaced by the submachine gun M3, 29.8 inches long, weighing 8.9 pounds, and with an extendable skeleton metal stock. The M3 is a more reliable weapon, is more easily manufactured, and costs but one-third the Thompson's price. Both use the caliber .45 pistol cartridge, but by use of an extra barrel the M3 also handles the German 9-mm. (Parabellum) cartridge.

tank (tk): A full-tracked, fully armored vehicle, heavily and offensively armed; in modern practice its armament includes a powerful gun or howitzer. Tanks are loosely classified as light (under 25 tons in weight), medium (25 to 40 tons), and heavy (over 40 tons). At the outbreak of the war in Europe we had the light tank M2A4, used by the cavalry and known as a "combat car"; by the time we entered the war this had been developed into the M3, an excellent vehicle of 27,400 pounds, with maximum speed of 36 m.p.h. and carrying a 37-mm. gun. Further development through the war years culminated in the light tank M4, of 38,750 pounds, with 35-mile speed, mounting a 75-mm. gun.

In 1939, our medium tank M2A1, though weighing but 20 tons and carrying a 37-mm. gun, satisfied the needs of that time for an "infantry-accompanying" vehicle; redesigned to meet new demands, it became the medium tank M3 (General Grant) weighing 30 tons and capable of 26 m.p.h. It retained the 37-mm. gun in a "cupola" turret but added a 75-mm. gun mounted in a sponson at the right front corner of the hull.

Shortcomings of the M3, shown in the African fight, resulted in the development of the M4 (General Sherman) a medium tank of 3½ tons' added weight, additional armor, no 37-mm. gun, but with its 75-mm. gun mounted, logically, in the turret.

Our first heavy tank, the M6, was accepted by the Army on December 8, 1941. It weighed 63 tons, was driven by an 800-horsepower radial engine at nearly the speed of a medium tank, carried armor up to 4 inches in thickness, and mounted a powerful 3-inch gun. Completed a year ahead of the German Mark VI (Tiger) tank, it was never sent abroad—though a 90-mm. gun had been successfully fitted to its turret—because of vast demands on always-limited ocean transport.

Designed to provide the firepower and armor of the M6 without its great weight and bulk, the heavy tank M26 (General Pershing) weighed 46 tons, was driven by a V-8 engine at 20 m.p.h., and mounted a 90-mm. gun equipped with muzzle brake.

tank destroyer: A much-used name for the gun motor carriage—especially for those which were armored and of high speed. "Gun motor carriage," however, properly includes all self-propelled artillery. The first notable American tank destroyer was the 105-mm. gun motor carriage M7; sent in numbers to the British, it did excellent work at El Alamein and later on many fronts.

A series of gun motor carriages, designed for tank-destroyer work, were constructed on various tank chassis and mounted a series of powerful guns in specially designed turrets. Examples are: M10 with 3-inch gun, M36 with 90-mm. gun, and M18 with 76-mm. gun—the latter notable for its road speed of 55 m.p.h.

Gun motor carriages carrying heavier weapons (not mounted in turrets) were the M12 and M40 with 155-mm. gun (the latter vehicle could mount the 8-inch howitzer interchangeably). Developed during the war but not used in action were the 240-mm. howitzer carriage T92 and the 8-inch gun motor carriage T93. Both weapons were interchangeable on the chassis of the heavy tank M26.

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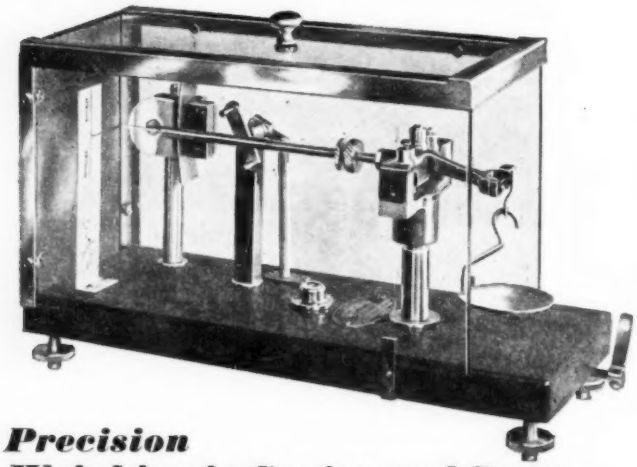

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Unit Histories, published by the Infantry Journal Press, Washington, D. C.

DURING the past year the Infantry Journal Press has been issuing a series of illustrated books which recount the achievements of various components of America's armed forces in World War II. The most ambitious of these histories is that of an entire army; yet a single battalion deemed its exploits of sufficient interest and importance to be memorialized in a separate volume.

Each book, written and edited by one man or, more commonly, by a team of writers, begins with an account of the activation of the unit, chronicles training exercises and maneuvers in the United States, gives a full account of combat participation and subsequent occupation duties, records all battle honors the unit may have received, lists the recipients of individual awards for gallantry in action, and concludes with a roster of officer and enlisted personnel.

The vast majority of the men who defeated the professional armies of the Axis were civilians recruited from all walks of life. The record of their achievements and occasional blunders is made permanent in these histories. But in a far wider sense their heroic deeds and those of their fallen comrades have grateful remembrance in the heart of a great democracy and are already woven into the stuff of other men's lives.

Let us now turn to the histories themselves. Thus far eleven books have been issued by the highly competent Infantry Journal Press.

---

(1) CONQUER: THE STORY OF THE NINTH ARMY. By Col. Theodore W. Parker, Jr., and Col. William J. Thompson. 404 pp. $4.50.

"CONQUER" was the code name of Lieut. Gen. W. H. Simpson's Ninth Army which came into being at Fort Sam Houston, Tex., on May 22, 1944. During nine months and ten days of combat duty it reduced the stronghold of Brest and made an assault crossing of the flooded Roer River.

In conjunction with the U. S. First Army it encircled and reduced the Ruhr—probably the greatest encirclement in military history. By driving 230 miles into Germany in 19 days, it was the first allied army to reach the Elbe. The hard-hitting Ninth certainly lived up to its code name! *(Continued on p. 122.)*

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(2) HISTORY OF THE XVI CORPS. By Col. Samson Z. Abelow and Maj. Paul F. Lueth. 111 pp. $5.

MAJ. GEN. JOHN B. ANDERSON'S Corps was activated on December 7, 1943, at Fort Riley, Kans. Arriving in France, the corps protected the Ninth Army's northern flank in the Roer River assault, driving the enemy from the Roer to the Rhine so relentlessly that enemy units in the north were unable to aid the hard-pressed German forces being hammered on other sectors of the Ninth Army front.

The corps smashed across the Rhine in a great amphibious operation and drove inexorably onward to assist in trapping crack German armies in the Ruhr Valley. It swept the Germans from the big industrial cities north of the Ruhr, including Essen and Dortmund, and then turned south as the Ninth and First Armies combined to crush all enemy resistance.

(3) WORKHORSE OF THE WESTERN FRONT: THE STORY OF THE 30TH INFANTRY DIVISION. By Robert L. Hewitt. 356 pp. $4.

MAJ. GEN. LELAND S. HOBBS' Old Hickory Division (Ninth Army) was formed from National Guard units of North Carolina, South Carolina, Georgia, and Tennessee. It landed in France in June 1944 and during the rest of the war performed, often spectacularly, in an efficient and destructive manner. After spearheading the St.-Lô break-through, it was called upon to repel the German attempts to split the American First and Third Armies at Avranches.

In one of the most decisive battles of the war, the 30th crushed the enemy assault and held open a vital corridor to the south. At Aachen, through Belgium, Holland, and on into Germany it continued the offense.

(4) XII CORPS: SPEARHEAD OF PATTON'S THIRD ARMY. By Lieut. Col. George Dyer. 561 pp. $5.

WHAT was the special character of the Third Army and, in particular, of Maj. Gen. Manton S. Eddy's spearheading XII Corps? At corps headquarters the standing order was "Can do." The bold solution was invariably preferred to the cautious solution. Informality was the keynote of all staff relations and practicality the touchstone of all decisions.

When XII Corps entered combat, the headquarters personnel had trained together for two years. They performed their jobs in an atmosphere of energy and aggressiveness and not without a certain grim humor.

What was true of headquarters was likewise true of the galloping ghosts in the ranks who advanced at the rate of 215 miles a month. One division of the corps, the 4th Armored, the spearpoint of the spearhead of Patton's army, won more than 4,000 individual decorations.

(5) THE 89TH INFANTRY DIVISION. By the 89th Division Historical Board. 270 pp. $5.

DURING the eight weeks in which the 89th was in combat, the men of the division displayed aggressiveness and know-how that was a tribute to their rigorous and thorough training. In the first three days under fire, the division advanced some fifty miles to the west bank of the Moselle River and bravely stormed across to establish a bridgehead through which the 11th Armored Division passed. The division also made an assault crossing of the Rhine River at St. Goar in the face of heavy fire and in spite of the most difficult conditions of terrain.

(6) LIGHTNING: THE HISTORY OF THE 78TH DIVISION. Edited by the Division Historical Association. 301 pp. $5.

MAJ. GEN. E. P. PARKER'S boys (First Army) began training as a unit in the spring of 1943. Teamwork, leadership,

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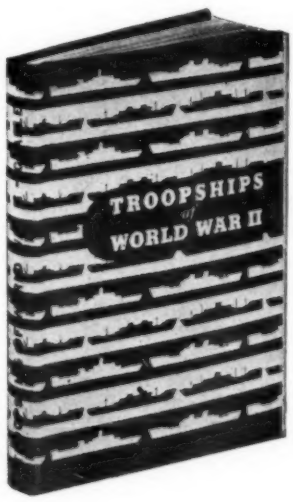

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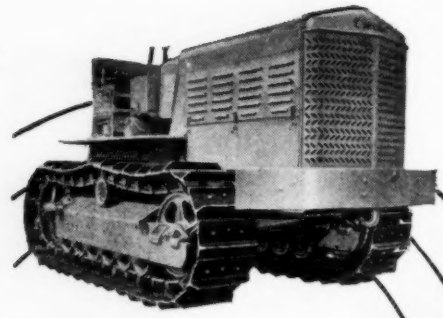

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Book Reviews

and courage were the foundations on which Parker built with work, exercise, and maneuver. The division embarked for Europe in October 1944. Within two months it had assaulted and breached the formidable Siegfried Line in Germany.

(7) History of the 398th Infantry Regiment. Edited by Bernard Boston. 204 pp. $5.

THIS regiment, commanded by Col. Robert M. Williams, landed at Marseille on October 20, 1944, and was assigned to VI Corps, Seventh Army.

After the bitter Vosges campaign came the assault on the Maginot defenses in the vicinity of Bitche in Alsace-Lorraine. This experience proved invaluable in the subsequent breaching of the Siegfried Line. Operating in Southern Germany, the regiment took part in a decisive battle in the vicinity of Heilbronn which, together with other allied victories, put an end to Nazi dreams of world domination.

(8) History of the 313th Infantry. Edited by the 313th Infantry Association. 203 pp. $5.

THIS regiment, commanded by Col. Paul C. Paschal, landed on Omaha Beach in Normandy on D plus 8. Its troops were the first into Cherbourg, the first to reach the Seine, the first across the Belgian border, and the first to establish a bridgehead on the Moselle. One battalion of the 313th, which entered Strasbourg with a French armored division, was the first American outfit to reach the Rhine. The 313th was one of the few divisions to fight as part of all four American armies on the Western front.

(9) The 6th Infantry Division. By the Division Public Relations Section. 180 pp. $5.

AMONG their many outstanding contributions to the final victory, wearers of the famous Red Star insignia fought the bloodiest battles of the New Guinea campaign and officially terminated it by making the last major amphibious assault at Sansapor; landed in the assault waves at Lingayen Gulf to spearhead the drive for the liberation of Manila; and drove across Bataan Peninsula, the first American troops to enter central Bataan since the infamous Death March.

(10) The Deadeyes: The Story of the 96th Infantry Division. By Orlando R. Davidson, J. Carl Williams, and Joseph A. Kabl. 309 pp. $5.

THE Deadeyes, commanded by Maj. Gen. J. L. Bradley, took part with distinction in several major battles in the Philippines. Between their first and last amphibious operations they killed 7,000 of the enemy and, under fantastically difficult conditions, accomplished every mission assigned them. In the words of the corps commander, General Hodge, it was a "brilliant and enviable" record that the 96th emblazoned on its banners in its first combat assignment.

Okinawa followed, and the Deadeyes discovered that Okinawa was a far different place—and a more pleasant one—than the Philippines. But the combat ordeal was far worse. In the opening round of the campaign the 96th suffered 2,000 casualties. Victory was achieved only after many days of violent action.

(11) The 233rd Engineer Combat Battalion. By Victor E. Weaver. 160 pp. $6.

THIS battalion took part in the assault landing with the 77th Division at Desposito, Ormoc Bay, in the Philippines. It also saw action on Ie Shima and Okinawa. In addition to normal wartime construction operations, it cleared mine fields and even assumed responsibility for malaria control.

—John J. O'Connor